



2
Med
A.

(24)

152

ANNALS OF SURGERY

UNIVERSITY OF TORONTO LIBRARY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY

LEWIS STEPHEN PILCHER, M.D., LL.D.,
OF NEW YORK

WITH THE COLLABORATION OF

J. WILLIAM WHITE, M.D., LL.D., OF PHILADELPHIA, Professor of Surgery in the University of Pennsylvania.	SIR WILLIAM MACEWEN, M.D., LL.D. OF GLASGOW, Professor of Surgery in the University of Glasgow.
--	--

SIR W. WATSON CHEYNE, C.B., F.R.S.,
OF LONDON,
Professor of Surgery in King's College

VOLUME LIII
JANUARY—JUNE, 1911

LONDON
CASSELL & COMPANY, LIMITED
1911

182434
11/7/23



ANNALS

SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

EDITED BY

LEWIS STEPHEN HUGHES, M.D., LL.D.

OF NEW YORK

COPYRIGHT U.S.A. BY
J. B. LIPPINCOTT COMPANY
1911

WHOLESALE AND RETAIL BY THE LIPPINCOTT COMPANY, NEW YORK

IN LONDON

Published monthly by the Lippincott Company, 233 N. 4th St., Philadelphia, Pa.

Entered as Second-Class Matter, May 1, 1879.

Postpaid. Accepted for mailing at special rate of postage provided for in Act of October 3, 1917.

Author's name

Editor's name

RD

1

96

v. 53

VOLUME 53

JANUARY 1911

PRINTED BY THE LIPPINCOTT COMPANY, NEW YORK

1911

CONTRIBUTORS TO VOLUME LIII.

ALEXANDER, EMORY G., M.D., of Philadelphia, Demonstrator of Fracture Dressings, Jefferson Medical College and Woman's Medical College; Assistant Surgeon, Kensington Hospital for Women; Surgeon to Out-Patient Department, Episcopal Hospital, and Children's Hospital, Mary J. Drexel Home.

ALEXANDER, SAMUEL, M.D., of New York, Surgeon to Bellevue Hospital.

AXTELL, W. H., M.D., of Bellingham, Wash.

BERNHEIM, BERTRAM M., M.D., of Baltimore, Md., Assistant in Surgery, the Johns Hopkins University.

BREWER, GEORGE EMERSON, M.D., of New York, Surgeon to Roosevelt Hospital.

BREWSTER, G. W. W., M.D., of Boston, Mass., Assistant Visiting Surgeon to the Massachusetts General Hospital.

BROWN, W. H., M.R.C.S., Eng., of Victoria, Australia.

BRUCE, HERBERT A., M.D., F.R.C.S., Eng., of Toronto, Associate Professor of Clinical Surgery in the University of Toronto; Surgeon to the Toronto General Hospital.

CHURCHMAN, JOHN W., M.D., of Baltimore, Md., Instructor in Surgery in Johns Hopkins University.

COBB, FARRAR, M.D., of Boston, Mass.

COLEY, WILLIAM B., M.D., of New York, Professor of Clinical Surgery, Cornell University Medical College; Attending Surgeon to the General Memorial Hospital for the Treatment of Cancer and Allied Diseases; Attending Surgeon to the Hospital for Ruptured and Crippled.

CORBETT J. FRANK, M.D., of Minneapolis, Minn., Assistant Professor of Surgical Pathology in the University of Minnesota.

CORSCADEN, JAMES A., M.D., of New York, Assistant Surgeon to the Out-Patient Department, Presbyterian Hospital.

- DAVIS, JOHN STAIGE, M.D., of Baltimore, Md., Instructor in Surgery, Johns Hopkins University; Assistant Surgeon, Out-Patient Department of the Johns Hopkins Hospital.
- DEAVER, JOHN B., M.D., of Philadelphia.
- EASTMAN, JOSEPH RILUS, M.D., of Indianapolis, Ind.
- ELIOT, ELLSWORTH, JR., M.D., of New York, Surgeon to the Presbyterian Hospital.
- ELSBERG, CHARLES A., M.D., of New York, Surgeon to the Neurological Institute; Associate Surgeon, Mt. Sinai Hospital.
- FAUNTLEROY, M. A., M.D., Surgeon in the United States Navy.
- FOWLER, H. A., M.D., of Washington, D. C.
- GIBSON, CHARLES L., M.D., of New York, Surgeon to St. Luke's Hospital.
- GIDDINGS, HAROLD G., M.D., of Boston, Mass.
- GIFFIN, H. Z., M.D., of Rochester, Minn.
- HARTE, RICHARD H., M.D., of Philadelphia, Surgeon to the Pennsylvania Hospital.
- HAWKES, FORBES, M.D., of New York, Associate Surgeon to the Presbyterian Hospital.
- HIBBS, RUSSELL A., M.D., of New York, Surgeon-in-Chief of the New York Orthopædic Hospital and Dispensary.
- JANEWAY, HENRY H., M.D., of New York.
- JOHNSON, ALEXANDER B., M.D., of New York, Surgeon to the New York Hospital.
- JOPSON, JOHN H., M.D., of Philadelphia.
- KELLY, HOWARD A., M.D., of Baltimore, Md., Professor of Gynæcology in the Johns Hopkins University.
- LILIENTHAL, HOWARD, M.D., of New York, Surgeon to the Mt. Sinai and Bellevue Hospitals.
- LINK, GOETHE, M.D., of Indianapolis, Ind., Assistant Professor of Gynæcology in the Indiana University School of Medicine.
- LONG, JOHN WESLEY, M.D., of Greensboro, N. C.
- MAKINS, GEORGE HENRY, C.B., F.R.C.S., of London, Surgeon to St. Thomas's Hospital.

- MARRO, ANDREA, M.D., of Turin, Italy, First Assistant to the Surgical Clinic of the Ospedale San Giovanni; Instructor in Operative Surgery.
- MARTIN, WALTON, M.D., of New York, Assistant Surgeon to St. Luke's Hospital.
- MATAS, RUDOLPH, M.D., of New Orleans, La., Professor of Surgery in Tulane University.
- MILLER, ROBERT T., JR., M.D., of Pittsburgh, Pa., Surgeon to St. Francis Hospital.
- MOORE, JAMES E., M.D., of Minneapolis, Minn., Professor of Surgery in the University of Minnesota.
- MOSCHCOWITZ, ALEXIS V., M.D., of New York, Visiting Surgeon, Har Moriah Hospital; Adjunct Attending Surgeon, Mt. Sinai Hospital.
- MÜLLER, GEORGE P., M.D., of Philadelphia, Associate in Surgery in the University of Pennsylvania; Surgeon to St. Agnes Hospital; Assistant Surgeon to the University and Philadelphia Hospitals.
- PILCHER, PAUL M., M.D., of Brooklyn, N. Y.
- ROBINSON, SAMUEL, M.D., of Boston, Mass., Surgeon to Out-Patients at the Massachusetts General Hospital.
- ROCKEY, A. E., M.D., of Portland, Oregon.
- SCHMITT, A. EMIL, M.D., of New York, Instructor in Operative Surgery, Medical Department of Columbia University.
- SHOEMAKER, GEO. ERETY, M.D., of Philadelphia, Gynæcologist to the Presbyterian Hospital; Consulting Surgeon to the Woman's Hospital of Philadelphia.
- SIMMONS, CHANNING C., M.D., of Boston, Mass., Surgeon to Out-Patients, Massachusetts General Hospital; Assistant in Surgery, Harvard Medical School.
- SINCLAIR, H. H., M.D., C.M., of Walkerton, Ont.
- STANTON, E. MACD., M.D., of Schenectady, N. Y.
- STEWART, J. CLARK, M.D., of Minneapolis, Minn., Assistant Chief of Surgical Clinic.
- THOMAS, T. TURNER, M.D., of Philadelphia.
- TURCK, RAYMOND C., M.D., of Jacksonville, Florida.

WARE, MARTIN W., M.D., of New York, Adjunct Surgeon in the Genito-Urinary Service, Mt. Sinai Hospital.

WATTS, STEPHEN H., M.D., of Charlottesville, Va., Professor of Surgery in the University of Virginia; Surgeon-in-Chief to the University of Virginia Hospital.

WHITMAN, ROYAL, M.D., of New York.

WILSON, LOUIS BLANCHARD, M.D., of Rochester, Minn.

ANNALS OF SURGERY

VOL. LIII

JANUARY, 1911

No. 1

ORIGINAL MEMOIRS.

TESTING THE EFFICIENCY OF THE COLLATERAL CIRCULATION AS A PRELIMINARY TO THE OCCLUSION OF THE GREAT SURGICAL ARTERIES.*

BY RUDOLPH MATAS, M.D.,

OF NEW ORLEANS, LA.,

Professor of Surgery in Tulane University.

I.

THE surgery of the vascular system bristles with problems which still await solution, but none appear to me more important or fundamental than the study of the collateral circulation in its behavior to occluded arteries and in the means of testing its efficiency or inefficiency before permanently obstructing the more important arterial channels of the circulation.

It must be apparent to all surgeons who have kept abreast of the great and phenomenal advances which experimentation in the laboratory and in the clinic have recently brought about in the treatment of the surgical diseases of the blood-vessels, that the general principles which have hitherto governed the treatment of the accessible surgical aneurisms must soon undergo revision. It must be conceded, to begin with, that the classic principle, that a diseased aneurismal or injured

* The President's address at the meeting of the American Surgical Association, June, 1910.

artery could only be made safe by the suppression of its blood-carrying function, whether by ligation, extirpation, or other means of obliteration (Scarpa), is rapidly yielding to the better appreciation of the true surgical ideal, which is to cure, if possible, without the suppression of the vascular function.

The need of preserving the function of the great vascular trunks, especially the great arteries at the root of the limbs, of the neck, and of the viscera, and the obvious dangers which attend their surgical obliteration have always been apparent to surgeons. But the fear of obliterative thrombosis and secondary hemorrhage and the difficulties of the technic by which the continuity of the vessel can be restored are even now so grave an obstacle in the way of the accomplishment of the ideal, that, in spite of the vast increase in the surgical resources by which this *restitutio ab integro* may be accomplished, many among us, even the most skilful, are led to follow the old beaten path, with its easy methods of obliteration, and trust to nature and the collateral circulation to supply the blood deficient in the suppressed area.

Were it possible in every given instance to determine, before undertaking an intervention, that the suppression of the blood-vessel under consideration would certainly and inevitably terminate in a fatal ischæmia and necrosis of the dependent territory, either the intervention would not be undertaken or the operator would, in doing so, prepare to avail himself of every method suggested by which the preservation of the main channel of the circulation could be assured. It is in the treatment of the peripheral aneurisms, whether of traumatic or pathologic origin, which involve the great arterial trunks at the root of the limbs or in the neck (especially those of the neck and lower extremities), that the desirability and utility of a test, by which the adequacy or inadequacy of the collateral circulation, *ante-operationem*, may be determined, is most keenly and urgently felt.

It is true that in the lower animals, which are practically free from arterial disease or degenerative cardiac lesions, all the arteries, including the thoracic and the abdominal aorta

below the renals, can be ligated with comparative impunity. It is also true, and for the same reason, that in children and young subjects with normal hearts and blood-vessels, the inherent capacity of the heart and vascular system for accommodation to the most variable and unexpected demands is quite sufficient to overcome the resistance of the undeveloped collateral routes, when obstacles are put in the way of the circulation even of the larger central and root trunks. But it is otherwise in adults or in the aged who have lost the elasticity and contractility of their arteries; in those who by congenital defects or anomalies in the distribution of the vessels (seemingly far more common in man than in the lower species); and, again, in all those who are suffering from acquired arteriosclerotic and obliterative processes, and with poorly nourished or otherwise defective hearts, there is a failure to provide the needed *vis a tergo* which is required to overcome the increased peripheral resistance. In this last category must be placed a large number of the victims of the pathological or so-called spontaneous aneurisms; the aneurism itself furnishing the most striking evidence of the underlying vascular cachexia.

While it is true that many individuals who bear the unmistakable stigmata of cardiovascular disease have been operated upon for aneurism and other vascular lesions by methods which suppress large arterial tracts, and have survived the ordeal without menace to life or limb; and while it is also true that by the direct and conservative methods of intra-aneurismal obliteration, which I have advocated so persistently during the last eight years, the number of necroses has been surprisingly small, considering the relatively large number of observations that have accumulated up to the present time, it is nevertheless true that in a certain percentage of cases the obliteration of a large surgical trunk, even in a very restricted area, will determine the death or fatal degeneration of the parts or regions supplied by it. It is, therefore, highly important and urgent that some satisfactory test or method be devised by which the indications for operation in any given case may be met, or at least anticipated.

As long as this is not done, the surgical treatment of aneurism will have to be conducted on an empiric basis, even as it is at present. We should not trust to chance, but we should know, with some approach to certainty, whether in any given case the main artery of a limb may be suppressed with impunity or it may not. If we are facing a femoral or a popliteal aneurism, how much more confidently we would attack it if we had a reasonable assurance beforehand that the life in the foot would be preserved even after the main trunk had been occluded at the aneurismal site!

While fully convinced that every peripheral aneurism involving a large arterial trunk should be approached from the operative side, with a fixed determination to preserve the parent trunk while suppressing the sac, experience clearly shows that this is impracticable in many instances, or that extraordinary measures, which may still be classed as uncertain, adventurous, or heroic (venous and arterial transplantations, arterioplasties, patching of arteries, etc.), may have to be resorted to if such a restoration is attempted.

What has been done to help the surgeon in determining the adequacy or inadequacy of the circulation, thereby furnishing a rational basis for the classification of his aneurisms from the operative point of view? Strangely enough, comparatively little attention has been given to this phase of the aneurismal question up to the present time.

In my paper on the statistics of endo-aneurismorrhaphy, read before the Surgical Section of the American Medical Association, at the Chicago meeting, June, 1908, I analyzed the reports of 85 operations performed by this method. Since that meeting, the statistics of the intrasaccular method have increased to 145. Of these, 127 involved the great trunks of the lower extremities from the iliac to the posterior tibials—the real testing ground of the operative treatment of the accessible or peripheral aneurisms. These statistics include up to the present time (April 29, 1910), 90 popliteal, 26 femoral, 2 external iliac, 7 iliofemoral, and 2 gluteal aneurisms. Combining the statistics published in 1908 (85 cases) with the

unpublished series of new cases which have been reported from June, 1908, to April 29, 1910 (60 cases), we find the total 145 cases may be grouped into the three operative types of endo-aneurismorrhaphy as follows:

1. Obliterative group (old).....	59	
Obliterative group (new).....	46	
	<hr/>	
	105	105 (72.4 per cent.)
2. Restorative group (old).....	13	
Restorative group (new).....	7	
	<hr/>	
	20	20 (13.7 per cent.)
3. Reconstructive group (old).....	13	
Reconstructive group (new).....	7	
	<hr/>	
	20	20 (13.7 per cent.)
	<hr/>	
	145	

[Since April, 1910, 4 more reconstructive operations (all successful) have been reported in the femoropopliteal tracts by Dr. Richard Harte, Philadelphia (2 cases), Dr. Gwathmey, Norfolk, Va. (1 case), and Dr. Vaughan, Washington, D. C. (1 case). In none of the cases gangrene, hemorrhage, or relapse has occurred. The total number of cases of all types of operation would therefore be 149 (to July, 1910).]

These operations have been performed chiefly by American surgeons, many of whom are young men of limited surgical experience, who have begun their apprenticeship in the surgery of the blood-vessel with this operation. These reports have been obtained largely through correspondence and personal solicitation, and have been massed together without selection just as they were reported to me; thus differing from some statistics presented by the compilers of the reports of other methods, who have gathered their material from the literature. Yet with all the disadvantages incident to first attempts, often by inexperienced operators, the total number of necroses or gangrene has not exceeded 5 cases in the 145. Of these five, 4 occurred in the obliterative group in the old series of 85

cases reported in Chicago in 1908 (4.8 per cent.); and 1 in the present series of 60 cases, or 1.9 per cent., also occurring in the obliterative group. I have elsewhere explained (*Journal American Medical Association*, November 14, 1908) that in 3 of the 4 cases of gangrene in the old series, one of the most important precepts of the intrasaccular method (respect for the veins) had been violated, and that the popliteal vein had been injured and ligated in each instance. In the last unpublished series of 60 cases, only one case of gangrene is reported, and this I cannot account for, as the details of the operation in this particular case have never reached me. Summing up the gross results, we find, therefore, a total of 5 cases of peripheral necrosis in 145 operations (3.4 per cent.), all occurring in the lower extremities, in operations of the obliterative type which constitute 72.4 per cent. of the whole number. No gangrenes have occurred after restorative and reconstructive cases, either in the new or in the old series, and no relapses in the cases reported of these two types since 1908.

Believing, as I do, that the intrasaccular method of suture furnishes the best conditions for the protection of the peripheral parts against fatal ischæmia by relieving the tension within the aneurism and the perianeurismal areas, thus giving the collaterals (if they exist at all) the best chance for the establishment of a compensatory circulation, it has, nevertheless, been a matter of great concern to me, before undertaking an operation, to know beforehand to what extent the collateral circulation could be depended upon should an obliterative procedure become an unavoidable necessity. The same thought must impose itself upon the mind of the prudent surgeon every time he is confronted by an aneurism of the carotid or innominate tracts. Here it is not only the safety of the limb that is at stake, but the life of the patient as well. This grave feature of the vascular surgery of the neck has become especially apparent since in the last few years our methods of attacking cervical and facial neoplasms by "bloc dissection" (Crile) have become so much more aggressive and radical in their scope. Hence, we find in the literature of the last three

years, the first evidences of the serious thought that this subject has suggested in the number of preliminary tests recommended before undertaking operations which might involve the suppression of one of the great arterial avenues to the brain. The progress accomplished in this direction is now quite satisfactory, as I will have occasion to show later, but the testing of the collateral circulation in the extremities has been regarded with far less interest than the subject deserves, and it is to this phase of the question that I will direct your attention. Again, in my Chicago address two years ago, in referring to the indications of the reconstructive operation, I said: "The method of determining the peripheral blood-pressure at the very tips of the extremities devised by the Russian surgeon Korotkow, as the result of his extensive experience in the treatment of arteriovenous and other aneurisms in the Russo-Japanese War, and applied successfully by him, Petrov, Fedoroff, Von Oppel, and others, may prove the final solution of the problem" (of determining the efficiency of the collateral circulation in the limbs). "If the peripheral blood-pressure, as shown by the manometer (a modified Gaertner's tonometer), is more or less sustained after the compression of the main trunk immediately above the aneurism, then the main trunk may be safely obliterated in the aneurismal sac. If, on the other hand, the blood-pressure falls to zero, it is evident that the collateral circulation is inadequate and that no chance should be taken with the obliterative operation, or with any procedure whatever (ligation, extirpation, etc.) which would permanently occlude the parent artery."

Since that address was published, the importance of devising some effective and simple means of testing the efficiency of the collateral circulation has been constantly kept before me by a number of cases of popliteal and femoral aneurisms, which have come to me for treatment. The problem has also more frequently repeated itself in the last two years in considering the practicability of extirpating the large root trunks involved in tumors of the thigh and arms. I soon found that Korotkow's method, as I originally understood its technic

through the very meagre details given by Von Ooppel in his paper on operative treatment of arteriovenous aneurism (*Arch. f. klin. Chirurg.*, 1908, Band lxxxvi, Heft 1) and by Petrov, of St. Petersburg, at the meeting of the German Surgical Association (*Verhandlung*, Berlin, April 3 to 6, 1907), was of comparative little value in the lower extremities where it was most needed. I found that the rubber rings, which are furnished with the Gaertner tonometer, are satisfactory enough in the fingers, but they are absolutely inapplicable to the toes, especially of adult individuals with deformed feet. I went to the extent of having special inflatable rings made for my Gaertner apparatus by a Philadelphia firm, which I intended to adapt to the toes; but these failed their purpose utterly, as they could not be satisfactorily adjusted; furthermore, in depleted and anæmic individuals with pale, exsanguinated extremities, the color reaction in the small area of the tip of the toes is too uncertain to be relied upon in making any accurate records, and is of still less value in the negro subjects who furnish a large contingent of our hospital clientele. Furthermore, the color reaction which is the basis of this tonometric test can be obtained on a far larger scale in a simpler and more satisfactory way by another vascular reaction, to which I will soon refer. E. Wolf, of Lexer's clinic, in his admirable paper "Die Häufigkeit extremitäten Nekrose nach unterbindung grosses Gefastamme" (*Beiträge zur klin. Chirurg.*, 1908, Band lviii, Heft 3) comes to the same conclusion after experimenting with the method of Korotkow in a case of arterial aneurism of the left femoral artery, complicated with advanced mitral disease. He says: "The measuring of the blood-pressure in the second toe with the Gaertner's tonometer proved difficult and of very little value on account of the pallor of the toes; it is sure not to be at all feasible in many cases." More recently, Kruger, of Riedel's clinic (Jena), in his critical article on aneurism, "Klin. Beiträge zur gefäss Chirurg." (*Arch. f. klin. Chirurg.*, 1910, Band xci, Heft 2 and 3), commenting upon Korotkow's suggestion says: "Aside from the fact that this method is applicable to only a

certain number of cases, no absolutely reliable conclusions can be based upon observation made with it. In high femoral and iliofemoral aneurisms it is plainly inapplicable." Further on, he very justly says: "It would be rash, in any event, to arrive at immediate conclusions. The collateral circulation may be very tardy in its development; it is certainly very variable, the cases in which it is established in a few minutes being in the minority. Whatever the precision of the method may be, it cannot be utilized to advantage for practical purposes. *Up to the present day we cannot tell positively in any case of ligature of the large blood-vessels, whether gangrene will or will not occur at the periphery.*" This significant statement, which clearly reflects the status of opinion on this subject in the most advanced centres of surgical culture in Germany, is the more reason why we should endeavor to fill this wide gap in our present knowledge of the physiopathology of the peripheral circulation.

Reverting again to Korotkow's test, it must be said, in justice to this able surgeon, that we know but very little of the details of his technic. I have tried to obtain a full and explicit statement of his method, as described by Von Oppel, but thus far have failed to secure a satisfactory and authoritative description.¹ I am prompted to these remarks by the fact that Korotkow's name is also attached to a method of determining the blood-pressure by auscultation of the peripheral arteries while the main trunk is undergoing compression with a sphygmographic cuff; but this bears no similarity to the method of Korotkow previously described, in which the pressure values of the tonometer are regulated by the appearance of color in the tips of the fingers.²

¹ I have written to St. Petersburg, addressing myself to Von Oppel, who is the best known expounder of his teachings outside of Russia, but I have failed to receive any reply to my queries.

² The details of the auscultatory method of Korotkow are given by him in a Russian publication (*Wratschnetnajir Gazeta*, 1906, No. 5). This method is especially valuable in measuring the minimum so-called diastolic pressure, and has been made the subject of several critical and experimental contributions since it was first brought to the notice of German

This method "which requires practice with great calm and patience" (Fischer) is evidently not intended to meet the requirements of our inquiry. However, whatever may be said of the method, great credit is due to Korotkow for first calling attention to the importance of making accurate observations before operating for aneurism, with a view of determining the efficiency of the collateral circulation after temporary obliteration of the main artery.

Among other means of determining the condition of the circulation after obstruction of the main trunk, I thought of Mosso's plethysmograph, or its various modifications, which could be used to register not only the oscillation of the blood current in the limb, but could give a graphic idea of the relative volume of blood in the extreme periphery of the affected limb, before and after suppressing the main artery. This apparatus was found solely practicable in laboratory experiments, and most difficult to use, if not totally impracticable, in the lower extremity where it was most needed.

The possibility of utilizing very sensitive surface and penetrating thermometers, which would register the differences in the temperature produced by the suppression and readmission of the blood supply of a limb, was also thought of; but it was found difficult to apply sufficiently delicate thermometers outside of the laboratory without serious traumatism to the ischaemic parts.

Putting aside a number of other suggestions intended to

clinicians by Fellner (quoted by Staehlin), "Zur Korotkows'chen Methode der Blutdruckmessung," (Verhdlg. des Kongress f. Innere Medizin, 1909, xxvi). Other excellent and full accounts of this method, as applied by internists, will be found in Lang (Geo.) & Mauswetowa (Sophia), St. Petersburg; "Zur Methodik der Blutdruckmessung nach v. Recklinghausen und Korotkoff" (Deutsches Archiv. f. klin. Med., 1908, Band xciv), and by Fischer, "Die Auskultatorische Blutdruckmessung in Vergleich mit der oszillatorischen v. H. v. Recklinghausen und ihr durch die Phasenbestimmung bedrugter klinischer Werth." These references may be profitably consulted by those who are especially interested on the subject. Since this paper was read in May, an excellent review of the whole subject of the auscultatory method, which is accessible to English speaking readers, has been published by Dr. G. C. Gettings, of Philadelphia, in the Archives of Internal Medicine, August 15, 1910, vi, No. 2, 196 *et seq.*

test the existence of the capillary circulation in the extreme periphery of the limbs, which have been suggested but which I have discarded as impracticable at the bedside, I have finally come to consider a modification of the simple proposition made by Moszkowicz, of Vienna, in 1907 (*Mittl. aus d. Grenzgebieten d. med. u. Chirg.*, 1907, Band xvii, Heft 1 and 2), and known as the "hyperæmia test" (which he introduced as a means of testing the limits of the active circulation in gangrenous limbs), as the most practical basis for the much needed test of the collateral circulation. Since 1907, when Moszkowicz's paper was published, I have had several opportunities of testing the value of the "hyperæmic blush" as a means of determining the line of amputation in senile and other presenile forms of arterial gangrene. In each instance, the test has come up to my expectations and, at least in one case, I was able to amputate below the knee, giving the patient the benefit of a better stump than if I had followed the old Heidenhain rule, which made it a routine practice to amputate above the knee, especially in diabetic patients. Since I have been familiar with this simple test, I have thought of its application in a modified form as a means of determining the efficiency of the collateral circulation before undertaking an operation for aneurism. I have also experimented with the hyperæmic reaction in healthy subjects, and this experience, together with the actual observation of its behavior in three recent cases of femoral and popliteal aneurisms, have convinced me that the Moszkowicz test, modified to adapt it to aneurismal conditions, is a valuable asset added to our diagnostic resources. By it, I believe, we obtain a clearer insight into the workings of the peripheral circulation, whenever the obliteration of an important arterial segment is feared or contemplated. The Moszkowicz test for determining the area of the viable or living parts, as distinguished from the dead, or dying, or ischæmic tissues (in cases of senile arteriosclerotic or thrombotic gangrene) is applied as follows: An Esmarch bandage is tightly applied from the tips of the toes or fingers by overlapping in the usual way, as a spiral bandage, to the root of the

extremity. In threatened gangrene of the toes and foot, the band is carried to the groin, where the constrictor or rubber tourniquet is applied. The bandage is allowed to remain from five to ten minutes. The constrictor is then released, and the downward progress of the reactionary pink wave of hyperæmia is observed as it travels to the periphery.

The red blush travels much more slowly as the obstructed territory is approached; it becomes less active and stationary as the total ischæmic areas of the foot or leg are entered. The red color spreads down hesitatingly, almost imperceptibly, especially at the toes. Individual anæmic patches, which are not yet necrotic but which are permanently deprived of blood or circulation, remain white, and the contrast between the red and pale districts becomes more marked with the extent of the arterial obstruction.

It is evident that any operation within the pale or cadaveric zone will end in sloughing of the flap. The proper place to amputate will then be well inside of the red or hyperæmic zone. Moszkowicz made numerous experiments, and found that by injecting colored fluids into the vessels of a cadaver, after ligating the main trunks at various levels, the fluid discolored the skin down to and a little below the level of the obstruction of the main artery. Apart from some variations, he satisfied himself that in the cadaver the limit of cutaneous permeability of the injected fluids was approximately an index to the level of the obstruction in the main trunk of the limb. He concluded from these laboratory experiments that, in practice, the level of the hyperæmic "blush" would approximately correspond to the level of the obstruction in the main artery.

The vast majority of the cases thus far reported, to which this test has been applied, are cases of gangrene of the leg associated with obliteration, partial or complete, of the popliteal artery. There are very few cases, if any, in which the test has been applied for other purposes than to determine the line of amputation in the leg.

Since 1907, Moszkowicz's "hyperæmia test" has been the subject of several contributions which have appeared in the

literature, including the latest articles of W. Bergmann, Lexer's clinic, Königsberg (Bruns' *Beitrage*, 1909, Band lxiii, Heft 1), that of H. Mendelsohn of Strassburg (Bruns' *Beitrage*, 1909, Band lxii, Heft 2), all tending to confirm the value of the test in establishing the line of amputation in cases of threatened or actual gangrene in the lower limb.

Leaving out of consideration the theories which have been advanced to explain the phenomenon of hyperæmic blush which follows the removal of the Esmarch bandage or any other constricting band at the root of an exsanguinated limb, there are certain facts worthy of remembrance in connection with the clinical application of the test. If the hyperæmia test is tried on the limbs of apparently normal individuals, it will be noticed that when the Esmarch constrictor is removed after it has been kept in place on the upper thigh for five minutes, the color of the limb, which is of a waxy, yellowish white, and cadaveric in appearance during the ischæmic stage, is rapidly transformed to a pink hue by a red blush which spreads, with greater or less rapidity, from the thigh to the toes. The intensity of the red blush varies with many conditions. In negroes and persons with very dark complexions, the blush is hardly appreciable, except at the soles of the feet, the nails, and the balls of the toes, which are not pigmented, and in the same regions of the hands. The reactionary wave is most striking in individuals of the fair, blond type. However, the blush is distinctly marked and unmistakable, even in the blackest negro, in the palms, soles and other parts previously mentioned. This is fortunate, because it is precisely in these terminal territories of the extremities that the life of the tissues is most frequently in doubt. The rapidity with which the blush spreads from base to periphery is not constant in all cases; in the minority, the knee is reached in from one to two seconds; the average time is five; the longest, fifteen seconds. The ankles become red quickest—after two to three seconds, average ten; latest appearance, twenty-five seconds; average fifteen seconds and, in the slowest cases, thirty seconds. Age has no essential bearing on the rapidity of the wave; according to Bergemann

the reactionary hyperæmia spreads more rapidly in the aged than in the young. "In a man, aged seventy-six years, the toes became pink in five seconds; in a child of four years, not until thirty seconds later." When the constricting bandage is kept in place a longer time, ten minutes for instance, the appearance of the redness is almost invariably delayed, but it becomes more marked when it does come. It is noteworthy that occasionally in some individuals, small, scattered, irregular patches remain like islands of white skin surrounded everywhere by the red blush. These patches, as first observed by Bergemann, are more often observed in the lower segment of the leg and on the dorsum of the foot. Once the hyperæmic wave has spread over the limb, it becomes intensified for a variable period of a quarter of a minute to one or even two minutes, then the redness becomes stationary for a few seconds and gradually pales to the normal living color in the course of five to ten minutes, or even longer. The retardation of the hyperæmic wave in proportion to the duration of the wave is accounted for (W. Bergemann) by an automatic reflex contraction of the vessels (possibly including in this the endothelial cells of the capillaries), which, at first, offer a resistance in the ischæmic zone which is greater in direct proportion to the duration of the ischæmia.

According to this view, the arteries and even the capillaries open their lumina wider in proportion to the blood famine. The returning blood relaxes the vascular spasm, but this spasm must be overcome before the returning capillary wave can advance further. This interesting hyperæmic reflex is more manifest in the young, because the automatic vasomotor mechanism is at the height of its physiological activity and the muscularis and other tunics of the artery are most efficient because they are free from degenerating lesions and influences. In the aged, the hyperæmic reflex of blood appears more promptly, owing to the impaired contractility and elasticity of the arteries; the spastic stage is not as lasting or as constant as in youthful individuals. It has been claimed that the failure of a reactionary hyperæmia to appear is indicative of the occlu-

sion of the main artery of the part, and in the cadaveric experiments of Moszkowicz, the colored fluids were usually arrested in the skin some distance below the immediate level of the ligature of the vessel.

The test, in the form originally suggested by Moszkowicz, has been utilized as a guide to the line of amputation in dry senile or presenile gangrene of the lower extremity—a very different matter from the application of the test in cases of aneurism. As the result of my clinical and experimental observation on normal individuals, the appearance of a hyperæmic wave after constriction of a limb is indicative of a free supply of blood in the hyperæmic area. *In healthy, normal limbs, the occlusion of the main artery of a limb does not, necessarily, suppress the hyperæmic wave in the distal parts below the obstruction, as long as the collaterals are pervious and sufficient to carry the blood beyond the level of the obstruction in the main artery.* The distinctness of the blush varies considerably according to the condition of the collateral circulation after constriction. The intensity of the blush would seem to be directly proportional to the activity of the collateral circulation. It is also true that as long as there is a reactionary blush or a restoration of the *living* color, no matter how faint it may be or wherever it may be, *there*, it may be said, the tissues are alive; while the indefinite persistence of a cadaveric pallor is ominous of a suppressed or impeded circulation.

It cannot be said, with Moszkowicz and others, that the presence of the hyperæmic wave means, necessarily, that the main arteries are pervious, or that if the blush does not appear the main artery is occluded. It is not so much as a test of occlusion of the main arterial trunk of a limb that I would advocate the Moszkowicz test, but as a means of demonstrating the existence of a capillary circulation beyond the level of the arterial occlusion—a pink color, no matter how faint, meaning life; a colorless cadaveric pallor meaning death.

Does the failure of the hyperæmic blush necessarily indicate that there is no circulation in the parts beyond the arterial obstruction? Not always; there may be no distinct wave, no

appreciable blush; but as long as there is some pink or "living" color—I mean color that can be made paler by pressure—there is some circulation; an absolute waxy pallor means complete ischæmia and ultimate death of the colorless parts if it persists.

In cases of senile or other forms of dry gangrene, we do not apply the Moszkowicz test to determine the level of the arterial obstruction, as he does, but solely to obtain a definite idea of the level of an active capillary circulation. My own clinical observations have convinced me that as long as there is a free or efficient collateral circulation, the hyperæmic wave, in an intense or modified form, will appear after the removal of the constrictor and will spread over the limb to every part of the periphery; it may not be as bright and brilliant as in a normal limb, but a living and gradually increasing living flesh color will appear, in spite of the occlusion of the main artery. The following observation will clearly prove my contention:

A young man, aged twenty-three years, was shot accidentally with a revolver in the right thigh, the bullet penetrating the middle third of the limb on the inner side. Shortly after the accident, a large pulsating hæmatoma developed, which his attending physician, Dr. Cunningham, recognized as an acute traumatic aneurism of the femoral. This occurred on December 26, 1909, at Sibley, Alabama, and on January 20, 1910, he was brought to me for treatment. There was a well-developed aneurism, involving the femoral just before its entrance into Hunter's canal. There was no evidence of associate venous injury. The tumor was growing rapidly. The operation was performed on January 21, about one month after the injury. The circulation was controlled by the Esmarch bandage and constrictor. The sac was opened freely, a large mass of rapidly organizing clot with a beginning endothelial lining was removed, exposing the injured femoral. The artery had been completely divided by the bullet, the ends retracting with the sheath for a distance of nearly one and a half inches. It was plainly an arterial injury without any sac formation. The divided ends of the artery were so far apart that no attempt at a circular or "end-to-end" arteriorrhaphy could be considered. I merely clamped the terminal ends

of the artery with soft rubber-covered (Hoepfner) forceps and, after securing all recognizable bleeding points in the wound, ordered the constrictor to be removed. We then watched for the hyperæmic wave. The constrictor had been on for about eighteen minutes, and the wave was delayed fully eighteen seconds before it appeared; then it came with a rush, right down to the knee; then it stopped, hesitated for a few seconds, and spread gradually, slowly but steadily, in the course of six minutes, to the very tips of the toes. The appearance of the leg and foot, which for fully five minutes had remained cadaverically pale, gave us great anxiety until we saw the pink blush gradually spread all over the foot and over each toe. The coloration of the toes and foot was not as intense as in the thigh, but it was quite sufficient to satisfy every one present that the peripheral circulation had been restored, and that the collaterals were efficient, though the dorsalis pedis and posterior tibial had ceased to pulsate. Had the reaction failed to appear and the cadaveric pallor remained, what then? I had fully decided that, in the event the collaterals failed, I would try to restore the continuity of the divided femoral by grafting a venous segment from the opposite saphenous. Realizing the uncertainty of this procedure, I was delighted that, with the help of the Moszkowicz test, we were able to obtain a most convincing demonstration of the efficiency of the collateral circulation, in spite of the occlusion of the femoral. I therefore ligated the ends of the divided vessel and closed the wound. The patient made an uneventful recovery, and the circulation in the foot never gave us a moment's anxiety, though the pulses at the ankle never returned.

After satisfying myself, by tests on normal individuals, that the occlusion of the main artery of a limb is no bar to the appearance of living color reaction, if not a hyperæmic wave, in the distal parts as long as the collaterals are intact, I devised the following test, which I have tried on a number of healthy individuals. The test was found very effective in two recent cases of pathological popliteal aneurism in markedly arteriosclerotic subjects, in whom it was especially important to know the condition of the collateral circulation as a preliminary to undertaking an endo-aneurismorrhaphy.

For the purpose of testing the collateral circulation in cases of aneurism, I have found that the tourniquet introduced about thirty years ago in the Massachusetts General Hospital for the purpose of applying immediate direct compression on the arteries as a substitute for digital compression in the treatment of aneurism, and known as the "Massachusetts Hospital Compressor" (manufactured by Codman and Shurtleff), is especially useful for this purpose. Better than any other compressor that I am acquainted with, the rubber pad over the wooden block, used as the compressing agent, can be adjusted to the artery more accurately and kept in place more steadily and with less interference with the circulation in the parts outside of the compressed area, which is not much larger than the surface covered by a silver dollar.

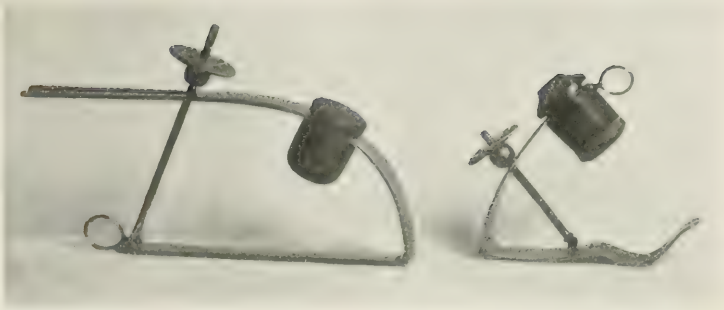
On the other hand, it has the disadvantage common to all compressors applied to the roots of limbs, that it obliterates the vessels in a very considerable and variable mass of tissue on a level with the flat compressing steel band, especially at the point where counterpressure is necessary to steady the appliance. It leaves a lateral area sufficiently free from pressure on each side of the axis of compression to allow the bulk of the collaterals to remain unobstructed (see Fig. 1).

Realizing the necessity of reducing the points of pressure and counterpressure to the strictest minimum compatible with a firm grip of the limb and a graded compression of the main artery, I have planned a different appliance based on the principle of a calliper, which is now under consideration by an instrument maker.

In testing an aneurism of the popliteal, which we may select as the most frequent example of the surgical type of this disease, the first step to be taken in applying the test is to put the patient on his back and expose the affected limb on a white cloth or sheet, which will show the contrast of the color of the skin to the best advantage. A good daylight is, of course, necessary.

Begin by determining the line of the femoral in Hunter's canal, and adjust the block of the compressor over this line

FIG. 1.



The Massachusetts General Hospital compressor used in testing the collateral circulation, two models: the larger for the lower extremity.

FIG. 2.



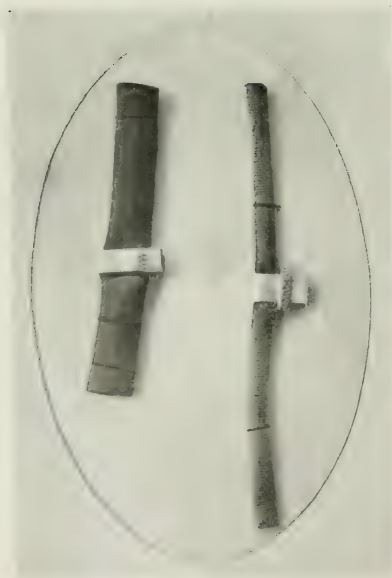
The compressor applied to the upper brachial artery. The elastic bandage should be applied more completely over the padded fingers than is shown in the photograph. The band should not extend beyond the upper pole of the aneurism. The upper pole should be exposed to permit the finger of the observer to determine the absence or presence of pulsation.

FIG. 3.



The compressor applied to the femoral at Hunter's canal. The same defective application of the elastic bandage occurs in this illustration as in the preceding photograph; the toes should have been completely covered by the elastic bandage.

FIG. 4.



Types of removable aluminum bands used to occlude the arteries.

FIG. 5.



The aluminum band used as an aneurism needle it is readily adjusted in this shape to the contour of the artery.

at a point nearest the aneurism without encroaching upon the sac. Then tighten the compressor on the artery until all pulsations and sounds cease in the aneurism and the volume of the swelling is reduced. At this juncture, if there is a peripheral pulse in the dorsalis pedis and posterior tibial, the pressure should be continued until these peripheral pulses cease absolutely.

After keeping the tourniquet on for some time while the aneurism is *absolutely still* and collapsed, some change may be noticed in the color, the temperature, and the sensibility of the skin below the knee and especially of the foot and leg. As the pressure is continued, the limb will become colder and paler at the digits, and the patient will complain of numbness and a dead feeling in the foot and leg. Observations on the color and temperature of the foot while the aneurism is "still" are in order. It is probable that as long as the collateral circulation is efficient, the change in the color of the limb, while becoming markedly paler at first and for some time after the compression is continued, will remain at a standstill or improve according to the efficiency of the collateral circulation. The variations in color noticed after simple compression of the main trunk above the aneurism are not always marked enough to allow the observer to arrive at definite conclusions, especially as the bulk of the blood originally in the limb before the experiment began has not been displaced by forcible exsanguination with elastic pressure.

After familiarizing himself with the position of the artery at the point *nearest* the aneurism, where it can be compressed with accuracy, the assistant is prepared to temporarily relax the pressure and proceed to the application of a broad Esmarch elastic bandage, which is to be adjusted snugly from the tips of the toes, compressing these more evenly over several layers of gauze, and continuing the roller until the upper level or pole of the aneurismal swelling is reached. At this level, the bandage is firmly held in position with a clamp and fixed while the operator readjusts the compressor until all pulsation in the sac is absolutely arrested and the aneurism is *stilled*. The

same tactics will apply equally well in arteriovenous aneurisms, though I have had no experience with this test in such cases.

With the finger of the operator constantly on the aneurism to make sure that its pulsation is absolutely controlled, the elastic bandage is held in place for five minutes in old subjects or eight in the younger patients, especially in dealing with traumatic cases (in these less risk of thrombosis, embolism, and injury to the artery). The elastic bandage is now quickly removed, while the compressor still secures the main artery.

Close attention must then be given to the returning hyperæmic wave, and the progress of the blush is noted as it descends rapidly at first in the zone immediately below the level of compression.

In order to test the collateral circulation in normal subjects by the method already described, the writer undertook this summer (1910) a series of observations on several members of the Touro Infirmary Staff, who kindly consented to the tests, which are detailed in the 11 observations which follow. Seven of the subjects were young physicians, members of the hospital corps, all vigorous and healthy; four were nurses in the training school, all normal, active young women. The circulation in the lower extremity was tested in the young men; the upper extremity, in the women. The ages of the men varied from twenty-two to thirty-one years; in the women from nineteen to thirty-three years. The blood-pressure was taken in the majority of the individuals experimented upon. This was done with a Cook's modification of the Riva-Rocci and an Olivier watch dial manometer.

The procedure adopted in testing the upper extremity was:

1. To elevate the arm, so as to drain all excess of venous blood and until the hand and forearm became pale from gravity anæmia.

2. The brachial was compressed with the Massachusetts Hospital compressor in the upper third of the brachial artery immediately below the insertion of the pectoralis major tendon, the compression continued until all the peripheral pulses (brachial at bend of elbow, radial and ulnar at wrist) were totally obliterated.

3. The effect of this procedure on the color of the extremity, and especially in the hand and finger-tips, was carefully observed by myself and two other medical members of the staff. All the variations in the color of the skin, and after of the sensibility and surface temperature were noted, varying from the waxy cadaveric pallor of complete ischæmia to a normal living flesh color or a hyperæmic pink. These observations were duly noted on the spot by a recorder, as they appeared successively in the arms, forearms, wrist, hand, palms, digits, and nails.

The same experiment was repeated in the majority of cases, with the addition of the complete ischæmia obtained by applying the elastic (Esmarch) bandage from the tips of the digits to the level of the compressor, which remained *in situ* after it had been demonstrated that the peripheral arteries were pulseless (Fig. 2). The elastic bandage was held in place from three to eight minutes, sometimes ten. On removal, the efficiency of the compressor in obliterating the brachial artery was demonstrated by the suppression of all the peripheral pulses and the persistence of cadaveric pallor. If there was the slightest evidence of a return of pulsation to the wrist or elsewhere, the experiment was repeated, the compressor readjusted, and the elastic bandage reapplied.

In the lower extremity, the femoral trunk was compressed with the block of the compressor resting on the artery at the apex of Scarpa's triangle, or a little higher in thin subjects (Fig. 3). The pulsations of the dorsalis pedis and posterior tibial behind the malleoli were completely noted before applying the elastic bandage. Then the color changes in the limb from the thigh to the toes were carefully noted after the removal of the elastic bandage while the compressor was *in situ*.

The brachial was always easily controlled; the femoral offered greater resistance to compression, especially in muscular subjects. However, the total suppression of the ankle pulses, together with the waxy, unmistakable cadaveric hue, always demonstrated the total ischæmia.

In presenting the individual observations, we have merely summarized the copious notes taken by the recorder and retained only the essential and most important notes.

OBSERVATION 1.—Dr. A. S. C., male, aged twenty-five years; normal pulse full and strong. Blood-pressure, 120. Compressor applied to brachial upper third; color remains in periphery including digits in spite of total obliteration of pulse at elbow and wrist.

Esmarch applied with brachial compressor <i>in situ</i>	22' 15"
Esmarch removed with brachial compressor <i>in situ</i> ...	23' 15"
Cadaveric pallor; no hyperæmic wave.....	23' 15"
Flesh color returns almost to wrist.....	26'
Better color in cadaveric palms.....	28'
Patches of red begin to appear in hand.....	30'
Pulps of fingers and palms are getting pink.....	33'
Brachial compressor removed	34'
The pink color is intensified and diffused like a distinct hyperæmic reaction	34' 15"

NOTE.—In this case, a living pink color was restored to the upper limb while compressor was *in situ*, in 11' 30".

Lower Limb.—Compressor applied to the femoral at the apex of Scarpa's triangle. Dorsalis pedis and posterior tibial pulses completely suppressed. Living color in limb unchanged.

While compressor <i>in situ</i> , Esmarch applied to middle thigh	42'
Esmarch removed, cadaveric color.....	43'
Red wave down to knee.....	43' 15"
Leg assumes living color to within 4 inches above malleoli	43' 30"
Foot still cadaveric	43' 30"
Foot and toes show living color (without hyperæmia). ..	43' 40"
Compressor removed, distinct hyperæmic wave over whole limb	43' 50"

NOTE.—Living color assumed in lower limb in spite of obliteration of femoral in 1' 40".

OBSERVATION 2.—Dr. M. J. deM., male, aged twenty-three years. Blood-pressure, 115.

Lower Limb.—Notable pallor on compression of femoral at Scarpa's triangle, sufficient to obliterate ankle pulses.....

Esmarch applied with compressor <i>in situ</i>	56' 15"
Esmarch removed with compressor <i>in situ</i>	59' 15"
Red wave to knee with compressor <i>in situ</i>	60'

Red color to mid-leg with compressor <i>in situ</i>	61'
Decided hyperæmia to tubercle of tibia.....	61' 30"
Still pale, but living color to ankle.....	62'
Living flesh color to malleoli.....	67'
Color begins to show in toes.....	69' 30"
Compressor removed	70'
Marked hyperæmic wave diffused over limb to toes...	70' 20"

NOTE.—In this case a living flesh color was restored to limb while femoral obliterated, in 10' 20".

OBSERVATION 3.—Dr. J. M. M., aged twenty-two years; good full pulse at ankle (blood-pressure not stated). Compressor applied to femoral at Scarpa's triangle; ankle pulses obliterated.

Esmarch applied at once and removed, leaving limb in cadaveric pallor	10'
Pink color appears to tubercle only of tibia.....	12'
Tips of toes pinkish.....	13'
Color returns to toes.....	15'
Compressor removed	15' 15"
Hyperæmic blush over whole limb.....	15' 30"

NOTE.—In this case a living flesh color returned while compressor was *in situ* in 5' 15".

OBSERVATION 4.—Dr. J. G. H., aged twenty-six years; full regular pulse (no blood-pressure record).

Upper Extremity.—Living flesh color retained after compressor applied to brachial upper third; the pulse at elbow and wrist obliterated

erated	41'
Esmarch applied	41' 30"
Esmarch removed (cadaveric pallor).....	44'
Hand still cadaveric.....	44' 30"
Little pink to elbow.....	44' 45"
Living color in forearm.....	45' 25"
Living flesh to wrist.....	46'
Some pink in hypothenar region.....	47'
Decided flesh color in palm and hypothenar region...	48'
Little pink in nails.....	49' 15"
Nails decidedly pink	50'
Living color over entire limb.....	50' 45"
Compressor removed; marked hyperæmic wave.....	51'

NOTE.—A normal living color restored to entire limb with compressor *in situ* in 9' 45".

OBSERVATION 5.—B. W. W., aged twenty-five years. Full pulse; blood-pressure, 120.

Lower Limb.—Compressor applied to femoral at Scarpa's triangle; slight pallor, though living color retained in spite of obliterated pulses. Very distinct hyperæmic blush over entire limb follows removal of compressor.

Compressor reapplied, pulses obliterated, and Esmarch applied to mid-thigh.....	38'
Esmarch removed	42'
Light pink color to internal condyle.....	42' 20"
Light pink color to heel.....	44'
Toes begin to show living color.....	44' 20"
Living color over limb.....	46'

NOTE.—Living color restored in this case throughout limb in 4', while compressor *in situ* and arteries pulseless.

OBSERVATION 6.—Dr. J. W. S., aged twenty-three years; full pulse; blood-pressure, 112.

Lower Limb.—Compressor over femoral at Scarpa's triangle.

Esmarch's elastic bandage applied.....	27'
Esmarch removed, cadaveric pallor.....	30'
Living color to knee.....	31'
Living color to tubercle of tibia.....	31' 15"
Living color at heel, dorsum of foot, and in big toe..	38' 30"
Living color in tips of toes.....	45'
Living color in whole limb, except big toe.....	46'
Compressor removed, followed by marked hyperæmic wave	46' 20"
Hyperæmic blush intensified.....	46' 55"

NOTE.—The living color was restored while compressor was *in situ*, in 19'.

OBSERVATION 7.—Dr. H. T. M., aged twenty-four years. Athletic. Blood-pressure, 122.

Lower Limb.—Compressor and Esmarch applied at Scarpa's triangle.

Limb pale and pulseless.....	12'
Living color to ankle.....	15'
Living color on dorsum pedis.....	16' 30"
Living color in toes.....	17'
Distinct hyperæmic blush while ankle pulses still obliterated	20'
Compressor removed, but no reactionary blush follows, as limb is already hyperæmic.	

NOTE.—In this case, not only the normal living color was obtained, but a distinct hyperæmic blush followed in 8'.

The experiment was repeated with practically the same results. It is

evident that the rapid restoration of the circulation with the hyperæmic blush, while the ankle pulses were obliterated, can only be accounted for by the existence of an unusually large collateral.

OBSERVATION 8.—Miss W., aged twenty years. Normal blood-pressure, 110.

Compressor applied to upper brachial, sufficient to obliterate all peripheral pulses.....	15'
Forearm shows living color to wrist; hand cadaveric.....	17' 2"
Little color appears in hypothenar region.....	18' 30"
Very slight signs of flesh color in hand.....	21'
Living red in palm and pulps of fingers, with disseminated cadaveric patches	31'
Compressor removed, hyperæmic flush returning.....	31' 10"
Hyperæmia intensified.....	31' 50"

NOTE.—Fully 18' 22" elapsed in this case before living color returned to extremity.

OBSERVATION 9.—Mrs. B., aged twenty-seven years. Blood-pressure, 115.

Compressor applied after gravity anæmia; pulses obliterated	29'
Arm and forearm show living tint.....	31'
Little color appears in pulps of fingers.....	36' 30"
Tips of fingers and nails show pink color.....	37' 30"
Living color spreads over fingers.....	39'
Compressor removed; hyperæmic flush returning.....	39' 7"
Hyperæmia intensified	39' 47"

NOTE.—Fully 10' elapsed before living color was restored after application of compressor.

OBSERVATION 10.—Miss B., aged thirty-two years. Blood-pressure, 100.

Compressor applied after gravity anæmia; pulses obliterated	39'
Distinct living color to wrist.....	41'
Esmarch bandage applied while compressor still <i>in situ</i>	44' 30"
Esmarch removed	47' 30"
Extremity cadaveric	48' 30"
Living color spreading to elbow and back of forearm.....	49' 30"
Forearm shows living color.....	52'
Living color in pulps of fingers.....	57'
Compressor removed; hyperæmic blush returning.....	57' 5"
Hyperæmia intensified	58' 5"

NOTE.—Living color restored in 10' after compressor applied.

OBSERVATION 11.—Miss S., aged nineteen years. Blood-pressure, 110. Gravity anæmia followed by compressor applied to upper brachial.

Pulse obliterated	10'
Living pink color spreads to elbow.....	10' 30"
Living pink color spreads to mid-forearm.....	12' 30"
Living pink at tips of fingers.....	12' 45"
Living color in palm.....	13'
Cadaveric color passing from hand.....	17'
Living color returning uniformly over hand.....	18' 30"
Compressor removed; hyperæmic blush returning....	18' 50"
Flush intensified	18' 50"

NOTE.—Living color restored in 9' 25", while compressor *in situ*.

SYNOPSIS.

Six observations on the *upper extremity* (brachial compressed); 4 women and 2 men; circulation restored during compression of brachial in minimum time of nine minutes, twenty-five seconds; maximum time, eighteen minutes, twenty-two seconds; average time, eleven minutes, thirty-seven seconds.

Six observations on *lower extremity* (all men). Femoral compressed at Scarpa's triangle. Circulation restored in minimum time of one minute, forty seconds; maximum time, nineteen minutes; average, eight minutes.

In summing up the results obtained from these experiments, it is at once apparent that while these observations are most encouraging and suggestive, they are still very incomplete from the point of view of numbers and the lack of observations on mature and aged subjects. It is also apparent that color reaction obtained in the majority of cases is not, strictly speaking, a hyperæmic reaction in a literal sense, and that it would be an error to expect in every case or even in the majority anything like the intense and rapidly diffused blush which is obtained after applying an elastic tourniquet, or after releasing the grip of the compressor or tourniquet on the main artery.

This wave of intense hyperæmia in its red, wave-like phase, is usually limited to the regions close to, or a short distance below, the level of the compressor. The intense hyperæmic blush gradually fades away into a pale pink or a simple flesh

tint without sharply defined margins, but quite sufficient to be distinguished by the careful observer as a living capillary tint in contrast with the dead, waxy, cadaveric hue of complete ischæmia. In view of the fact that peripheral arteries, at the ankle or wrist, remain pulseless while the parent trunk is compressed, it is not likely even if one of these vessels, such as the dorsalis pedis, were cut into, that blood would flow in a stream; all that could be expected would be a sluggish capillary ooze which would no doubt increase as the experiment was prolonged and the collateral circulation asserted itself. The capillary bleeding would be quite sufficient to confirm the existence of a circulation in the areas below the level of the compression. In some of the cases in which a positive pink color and even an intense hyperæmic blush is noticed in the distal parts, it is more than likely that a free hemorrhage would follow a cut into one of the tissues. However, the important point that is fairly proved is that in spite of absolute pulselessness, a normal, living flesh, pinkish color is all that is necessary to indicate that the limb is alive and not likely to perish from ischæmia. These experiments also show that the elastic constrictor is not essential to obtain the hyperæmic or other color reactions. The only reason why it is preferred to gravity anæmia is that it is more effective in obtaining that absolute ischæmia which is followed by the typical, waxy, cadaveric hue of perfect bloodlessness, and that, in this way, the eye of the observer is better able to follow the color changes that occur after its removal. It is also more valuable than gravity anæmia for the same reason, viz., that the vascular reaction is more intense and visible in proportion to the completeness of the preceding ischæmia.

In aneurisms, especially popliteal aneurisms, in which the ankle pulses have been obliterated spontaneously by probable embolic or thrombotic obstruction of the tibials (a not infrequent occurrence in practice), gangrene of the foot ensues if the collaterals are not sufficiently developed. The survival of the limb after such an accident and the preservation of a normal color and sensation in the peripheral parts, in spite of the loss of the ankle pulses, clearly prove that a compensatory

circulation has been established and that no fear of gangrene after obliteration of the main artery or of the aneurism itself need be entertained. This relative immunity from gangrene of patients suffering from aneurism, who have lost their peripheral pulses (ankle pulses) without gangrene or impairment of the nutrition of the foot, has been long noticed by French observers, and is clearly founded on sound reasoning. (See *Bull. et Memoires de la Société de Chirg. de Paris*, 1909.)

In addition to the preceding considerations, the question of how long the compressor can be kept *in situ* waiting for the color reaction to appear arises.

Does the persistence of the cadaveric hue for one hour or more necessarily prove that the limb will not survive the occlusion of the main artery, if this is attempted?

Judging by mere clinical experience, the answer is certainly no. But if a limb remains cadaveric, cold, and numb, and never changes color for an hour in spite of hot air baths, massage, etc., it should make us very cautious how we undertake the obliteration of the parent artery. Furthermore, it is a question how long patients can endure the pressure of a mechanical tourniquet steadily applied to the main artery for diagnostic purposes. Many of the young men and women tolerated the pressure for eighteen and twenty minutes with comparative ease, but it is doubtful if every one could stand it longer than an hour without much suffering. In some instances in which it is very important to know the state of the circulation, the sitting might be prolonged by occasional inhalations of ether. However, a sitting of one hour under the compressor without changing the cadaveric hue would suffice to put the operator on his guard, and justify his postponement of the operation.

The following experience with a case of popliteal aneurism will serve to illustrate the mode of testing the collateral circulation, and also show how satisfactory it is in practice:

C. P., German, laborer, aged forty-two years; was admitted June 26, 1910, at the Touro Infirmary, for the treatment of a

large, well-developed aneurism, which filled the right popliteal space. There was a history of syphilis, gonorrhœa, and rheumatism, but no alcoholism. The aneurism developed nine months before admission, while the patient was working in a lumber camp, when he slipped while straining every muscle to prevent a load of lumber from sliding off a wagon. He particularly strained his right knee, but it was not until January 22, 1910, nearly two months subsequent to the injury, when he awoke to find his right leg stiff and swollen from the knee to the ankle. Since then a characteristic pulsating tumor, presenting all the classical signs and symptoms of aneurism, has gradually developed, and led to a complete disability on account of swelling and pain in the limb, when he attempted to stand or work for any considerable length of time. The aneurismal limb was cedematous and larger by one inch in circumference on a level with the patella, calf, and supramalleolar regions.

With the inflatable Cook's cuff as a constricting band, applied at the mid-thigh, the aneurism was not *stilled* until the dial of an Olivier manometer registered 150 mm. mercury.

On admission, the collateral circulation was tested as follows:

An Esmarch elastic bandage was applied from the toes to the upper pole of the aneurism in the popliteal space, allowing enough of the pulsating tumor to remain exposed for digital exploration, in order to control the efficiency of the compressor in arresting the circulation in the aneurism. The observations recorded by Drs. Gamble and Moore, internes of the service, are as follows:

Esmarch applied to upper level of aneurism....	11.29.00 A.M.
Compressor applied to femoral at Hunter's canal; the aneurism collapsed and <i>still</i>	11.35.00 A.M.
Esmarch removed	11.40.00 A.M.
Distinct living flesh color appeared as far as knee	11.40.05 A.M.
Color as far as tibial tuberosity.....	11.41.00 A.M.
As far as lower calf and malleoli.....	11.41.20 A.M.
Distinct living color in foot with decided hyper-æmia in calf	11.41.30 A.M.
Toes pink	11.42.00 A.M.
Foot shows a pink color.....	11.42.30 A.M.
Foot is hyperæmic	11.43.00 A.M.
The compressor was removed at	11.43 A.M.

The hyperæmic blush became diffused over limb and was intensified immediately after compressor was removed.

In this case it took just three minutes to restore a living color to the entire limb with marked hyperæmia of the foot, while the compressor was *in situ*, the aneurismal pulsation and the dorsalis pedis and posterior tibial pulses being completely obliterated in the meantime.

The experiment was repeated several times as a demonstration before students and visitors, and always practically with the same result. The only conclusion was that in this case the collaterals were very well developed and that the obliteration of the aneurism could be effected without fear of dangerous ischæmia to the limb.

NOTE.—On account of a severe burn, caused by accidentally rubbing the affected leg, including the aneurismal site, with carbolic acid instead of alcohol, the operation on the aneurism was delayed until August 22, 1910. This misfortune, however, did not prevent the final confirmation of the excellence of the collateral circulation indicated by the preliminary tests, as is shown by the following notes taken at the time of the operation.

C. P., ether (drop) narcosis. Operation begun at 11.40. Completed at 1.15 P.M. (including all dressings). Esmarch constrictor applied at mid-thigh. Sac opened and large amount of organized clot removed. Fusiform sac with two openings at each pole on same horizontal level. Space between inlet and outlet nearly three inches. After toilet of sac, a typical obliterative endo-aneurismorrhaphy was performed. Sac buried without drainage. Contents removed and a hyperæmic wave was noticed as far as knee in fifteen seconds.

A distinct flush as far as middle of calf in.....	1'
Living flesh color, but no hyperæmic wave at foot	
or sole of foot in.....	1' 40"
Living color in the foot in.....	2'
Nor. pink color in sole of foot and tips of toes in.....	3'

Therefore in *three* minutes after the constrictor had been removed, it was plain to everyone that, while the hyperæmic blush had been limited to a zone extending just below the level of the obliterated popliteal, a distinct living, and unmistakable pink color had spread gradually all over the limb to the toes. The transformation from a cadaveric pallor to the living pinkish color was easily followed in this patient, as he was of a very fair, blond,

German type. The dorsalis pedis and posterior tibial pulses were permanently suppressed by the operation.

The normal warmth and sensibility of the foot and toes returned in a few minutes after operation, and the patient made an uneventful recovery, save for a superficial suture suppuration, which occurred in the site of the carbolic acid burn.

Another and earlier experience (March, 1910) with the preliminary test of the collateral circulation as applied to a pathologic popliteal aneurism presents features which are most instructive and worthy of special consideration.

The patient, A. B., a lawyer, aged forty-five years (of Greenville, Miss.), was referred to me through the courtesy of his attending physician, Dr. P. E. Odeneal.

He showed marked evidence of general presenile arteriosclerosis, with a loud but well-compensated mitral lesion. He had noticed the aneurism fully eighteen months before he came to me for treatment.

The aneurism was ovoidal in form and filled the left popliteal space. It involved the entire space, but bulged upwards, encroaching upon the lower femoral tract. In view of the marked thickening of the peripheral arteries and unmistakable stigmata of arterial degeneration and high blood-pressure, I was especially anxious to test the collateral circulation. The hyperæmia test, as above described, was applied. The compressor was adjusted to the femoral at the lowest level of Hunter's canal, until the aneurism was stilled completely. The elastic bandage was applied and allowed to remain eight minutes. It was most interesting to watch the wave of hyperæmia as it rapidly descended at first to the middle of the leg, then hesitated, but slowly and steadily spread to the toes. The reddening of the entire limb was complete within two minutes.

With this evidence before me of what I considered a fair proof of the amplitude and sufficiency of the collateral circulation, I decided to attack the aneurism the next day, feeling confident that, if the conditions in the sac were not favorable for either a restorative or reconstructive endo-aneurismorrhaphy, the obliterative type of operation could be adopted without risk to the limb. Instructions were, therefore, given to prepare for the operation the next morning. When the hour came to operate, on March 1,

I again examined the limb, and much to my surprise, I found the foot and leg pale and colorless, and much colder than the foot on the opposite side. The patient had passed a restless night, and complained several times of sensations of numbness in the affected leg. His blood-pressure was higher than on the previous day by at least 20 mm. with the Riva-Rocci sphygmomanometer. This was attributed to worry and apprehension, but what was unsuspected and most significant was the total disappearance of the pulse in both arteries of the foot. The dorsalis pedis and the posterior tibial were readily identified as thick cords, but pulseless. What had happened during the night, is the question? The only rational explanation that I could conjecture was, that an embolus had been detached from the sac after the removal of the compressor the previous day, and that this had blocked the popliteal at its bifurcation. The aneurism itself pulsated as vigorously as ever. In the presence of this complication, all idea of operating upon the aneurism was abandoned, and the patient was brought back to bed and warmed up; the limb itself was placed in a hot air chamber, with the view of inducing as much active hyperæmia as possible. This was kept up for one hour, to be followed by an active massage over the whole leg, beginning at the tubercle of the tibia. After this, hot water bags were kept around the limb, which was wrapped in thick, large rolls of cotton batting.

Two hours after these measures had been taken the limb was found much less pale, sweating in the leg had occurred during the hot air treatment, and the nails were less pale and dusky. A very faint but appreciable pulsation could be detected in the posterior tibial. In six hours the color of the limb and the sensibility were almost normal, and the posterior tibial could now be felt beating vigorously behind the posterior malleolus, though no pulse returned in the dorsalis pedis. Presumably, the embolus had been partially dislodged from the bifurcation, leaving the lumen of the posterior tibial free, while the anterior was still blocked. At any rate, a collateral circulation had been sufficiently established to protect the foot. This would have been a good opportunity to try the hyperæmia reaction, but the fear of dislodging some more clot and again occluding the tibials made me desist. I then decided, in view of the return of circulation, to try the hazard of an operation. Accordingly, that same evening, the patient was etherized, and with the circulation controlled with

the Esmarch constrictor at the mid-thigh, a free incision was made into the sac, with extra precautions to avoid injury to any of the perianeurismal veins or nerves. The sac was opened freely, and a large mass of soft and partially laminated clot, amounting to about two cupfuls, was removed. The sac wall was tough and dense, and the two main orifices were clearly identified in the neighborhood of each pole, separated by a distance of nearly two and a half inches. There was no distinct groove at the bottom of the sac, and no folds to indicate a trace or vestige of the parent artery. Evidently the aneurismal dilatation involved the circumference of the artery, forming a typical fusiform sac, except for the flattened floor caused by the resistance of the posterior surface of the joint. After completing the toilet of the sac by gently scrubbing it with a salt water gauze pack, the orifices, which were quite large, were gently explored with a soft rubber catheter lubricated with sterile vaseline. The catheter readily passed into the lumen of the distal trunk for a short distance before engaging into a narrower channel, which I took to be the posterior tibial. A long, narrow, blunt-pointed forceps, well lubricated with sterile vaseline, was also introduced into the lumen of the distal trunk to the bifurcation, with the hope that some clot might be extracted, but owing to the need of great caution to avoid injuring the intima, only a small filamentous clot was extracted. I thought then of re-establishing a provisional channel at the expense of the vessel coats (reconstructive endo-aneurismorrhaphy) but the relative freedom of the posterior tibial, as shown by the pulsation before the operation, led me to decide for the obliterative procedure. The orifices were, therefore, sutured separately, and the sac was completely obliterated with buried rows of iodized gut and closed without drainage. On removing the constrictor, the hyperæmic wave was long delayed, fully half a second, when it came with a rush down to the tuberosity of the tibia, then very slowly it progressed a little further, becoming paler as it went on to the middle of the leg and stopped. The lower leg and foot were waxy, cold, and cadaveric. No pulse at the posterior tibial; no sign of life.

We endeavored to encourage the hyperæmia by pouring hot water and bathing the limb in a hot salt solution, but to no avail. I was beginning to despair after waiting an hour, and was seriously thinking of reopening the sac and attempting extirpation of the sac and venous transplantation, when it appeared to me that

the nails showed a pale trace of color and that the pulps of the toes were less waxy. The wound was dressed and the limb copiously padded with cotton wadding and put on a posterior gutter splint, with a separate dressing, to allow easy inspection of the toes. The patient, who had not lost a drop of blood in the operation, was in excellent condition, with a slow, full pulse; nevertheless, I ordered hypodermics of strychnine and digitalin, with enemas of black coffee, diluted in saline solution, and given as a Murphy drip. All this was done with the idea of increasing arterial tension, creating a hypertension, if possible, to strengthen the systolic wave and force the collaterals. As soon as the patient recovered from the anæsthetic, which he did promptly, the whole leg was placed in a hot air apparatus, in this following the suggestion of Ropke "Aktive Hyperæmie in der behandlung arteriosklerotische Gangran" (*Münch. med. Woch.*, 1907, No. 14), who has obtained good results in stimulating the collateral circulation by inducing active hyperæmia with hot water bags.

After this treatment, the limb was kept quiet and warmed with large hot water bags. The patient at first stated that his foot felt dead; shortly after the hot air treatment he complained of severe burning pain, especially in the heel and toes, and in two hours he expressed himself as quite comfortable. After two hours of great anxiety, the foot was examined and found to show some color, though still quite pale; by night it was warm and sensitive, with a marked return of the plantar reflexes.

Next morning the foot looked normal, though neither pulse at the ankle could be felt. On the eighteenth day after the operation, the patient was discharged and returned to his home in Greenville, Miss., with his wound completely healed, able to walk, and with good control of the extremity.

I have consumed some time in the description of this case, because it teaches at least two lessons: (1) that the hyperæmic reaction as applied in testing the collateral circulation in peripheral aneurisms is reliable when applied in conditions which permit the observer to gauge the efficiency of the compression by the state of the peripheral pulse; (2) that notwithstanding its simplicity, it is not free from risk. This risk, however, is common to all diagnostic and therapeutic methods which arrest temporarily the circulation of the blood in the

aneurismal sac. In any ordinary examination of an aneurism by digital compression, the temporary suppression of the circulation by applying the finger to the main artery on the proximal side is followed by a rush of blood into the sac when the pressure of the artery is removed. This usually is followed by no evil consequences, but it is easy to conceive that in individuals with highly coagulable blood, the temporary stasis of the blood in an aneurism may favor the formation of soft coagula or passive clot, which may be easily washed into the outlet, as emboli, with the next stream of blood that is pumped into the sac after the release of the proximal pressure. This risk is no doubt greatest in sacs which already contain a considerable amount of soft clot, and is also more liable to occur in fusiform aneurisms in which the inlet and outlet of the sac lie on the same level.

The sacciform aneurisms, with a single opening or communication, are, for obvious reasons, less liable to this accident, and the fusiforms, with openings at different levels, are safer from this point of view. But, since the type of sac can never be determined until the aneurism is opened, we cannot foresee in what particular case this contingency may arise. On the other hand, the same embolic phenomenon accounts for the occasionally and equally rare cures of aneurism which occur after a single brief interruption of the current effected by the finger of the examiner, who is merely investigating the case for diagnostic purposes. Cases of gangrene of the leg and toes after digital and instrumental compression (Reed's method), etc., in which the aim of the surgeon was to favor the coagulation of the sac contents by arresting the circulation temporarily, were not at all rare in the days when these methods were in vogue. And it is precisely because the clot is completely removed, and the sac is so thoroughly emptied in the operation for the cure of aneurisms by the intrasaccular suture method, that this method may claim a decided advantage over the ligature and the older methods.

It is evident, however, that there must always be some risk of peripheral gangrene by embolic or thrombotic obstruction in the sac or beyond it, regardless of any method of treatment

adopted. The proof lies in the fact that cases of spontaneous gangrene of the foot and leg, caused by aneurism, especially the popliteal, are not of extremely rare occurrence, as is shown by the numerous references in the literature. I have seen three such cases. The displacement of emboli from an aneurismal sac is one of those risks which is clearly unavoidable. It is fortunate that such occurrences as I have described in my case are extremely rare. The essential question is: Does this possible, but exceedingly improbable, occurrence of peripheral embolism argue against the application of the hyperæmia test, as I have described it? Does the risk of a possible embolus outweigh the great advantage to be obtained by a better knowledge of the efficiency of a collateral circulation as a preliminary to a radical operation? I think not. After considering the facts before me, I will not hesitate to avail myself of this most valuable and practical method of exploration in cases that may in future come under my observation. I must continue to regard it as a most valuable asset in the investigation of the collateral circulation. In connection with the risk of embolism, I feel that in addition to the advantages of the apparatus I have described in testing the efficiency of the collateral circulation, it is possible that it may be utilized to advantage in developing the circulation when this is deficient, as shown by the test. The Japanese (Kókuzi, Saigo, Tanaka), with their very large experience in traumatic aneurisms, as a result of their late conflict with Russia, believe in and recommended the systematic compression of the main trunk to develop the collateral circulation some time, days or weeks, before a radical operation. If it is comparatively easy to determine the efficiency of the collateral circulation by the hyperæmia reaction in the manner I have suggested, it will also be a simple matter to watch the improvement in the collateral flow by the re-application of the same test.

During these periods of observation and before beginning any investigation of the collateral circulation by a method that must necessarily interrupt the blood current in the aneurismal sac, it may be advantageous to obtain some information on the coagulability of the patient's blood.

The coagulation of the blood could be easily determined in every case by Wright's method, so that if the coagulation time is shortened, proper methods of treatment may be instituted which may tend to diminish the coagulability and thereby lessen the risk of embolus. Contrary, therefore, to the older practice, which strained every effort to induce coagulation in the sac as a means of cure, subjecting the patient to a reduced dietary with almost a total suppression of water (Valsalva, Tuffnel, Billingham), and bleeding to increase the fibrin content of the blood, we would adopt the opposite plan, which is to supply an abundance of fluid, allowing the patient to drink freely of citric acid lemonade or solutions of the acid citrate of sodium, as suggested by Wright in neutralizing the increased coagulability of the blood and the tendency to thrombosis, observed in the febrile infectious diseases (typhoid, etc.). Following Wright's suggestion again, these patients should not, during the period of observation, be given milk, as it has a large calcium content which favors coagulation. It is only in the inoperable and inaccessible internal aneurisms that the methods which favor the formation of clot in the sac are justifiable.

I believe I have said enough to direct your attention to at least three propositions: (1) that in the treatment of the surgical or operable aneurisms of the extremities, a preliminary knowledge of the resources of the collateral circulation is very desirable, if not absolutely necessary, in view of the possible obliteration of the main trunk in the course of the intervention; (2) that in the modification of the "hyperæmia test" which I have described, and which has thus far satisfied my clinical needs (in so far as the peripheral aneurisms of both extremities are concerned), we have a simple, practical means of obtaining approximate, pre-operative information in regard to the status of the collateral circulation; furthermore, (3) that the same method may prove of value by systematic compression of the main trunk, in developing the collaterals when these are found deficient. Finally, while fully realizing that the suggestions embodied in this paper represent only a crude

and unfinished effort to solve a really important problem, I merely submit it for discussion and further investigation, hoping that the simplicity and ready application of the method proposed will commend it to the attention of practical surgeons.

II.

So much, then, for the peripheral aneurisms of the extremities in which the main trunk of the limb on the proximal side can be compressed; but how about the aneurisms of the iliofemoral and iliac groups and those of the aortic bifurcation below the renals? How about testing the collateral circulation in the innominate and subclavian tracts? How about the still more dangerous aneurisms of the common and internal carotid trunks? These are all separate and distinct problems, but of varying importance from the point of view of the collateral circulation.

Thus, the obliteration of the iliac trunks, from the bifurcation to Poupart's ligament, is fraught with much less peril of peripheral necrosis than the ligation of the vessels below the groin. In the upper extremity, the importance of the collateral circulation from the point of view of necrosis is still less urgent. In the neck, the carotid tracts offer the gravest problems in the way of determining the efficiency or deficiency of the collateral circulation in the circle of Willis. However, I am glad to say that the obstacles in the way of a preliminary test of the circulation and the viability of the distal parts, after the occlusion of these great trunks, are not insuperable with the technical resources now at our command.

In previous publications (see "Statistics of Endo-aneurismorrhaphy, etc.," *Jour. Amer. Med. Assoc.*, November 14, 1908, li, pp. 1667-1671; Keen's *Surgery*, v; *Surgery of the Arteries*, "Carotid Aneurisms"), I have already referred to the importance of testing the collateral circulation in dealing with all operations on the neck, including all tumors, malignant neoplasms, which in the course of their extirpation or surgical treatment might require the obliteration of one or both carotid tracts (common and internal carotids especially).

A long and abundant experience with the surgery of the

carotid artery, amounting in a period of twenty-five years to over 78 ligations and extirpations of the common trunk and its two branches, has fully convinced me that the risk of fatal intracranial and cerebral complications resulting from an insufficient collateral circulation are not to be underestimated. Entirely apart from the secondary risk of sepsis, the immediate dangers of cerebral ischæmia deserve the most serious consideration on the part of the surgeon.

In the surgery of the arterial trunks of the neck more than elsewhere in the body, I have felt the need of some preliminary information as to the adequacy of the cerebral circulation before undertaking any operation which might involve the permanent and unavoidable obliteration of one or both carotid tracts. The need of some test has been more acutely experienced in recent years since the surgery of the neck has become far more aggressive than in the past. I have elsewhere referred to the stimulating work of W. S. Halsted, Crile, Jordan (of Heidelberg), Doberauer, of Saiger, and of Riess and others who have demonstrated, in a conclusive way, the tolerance of the large arteries to prolonged occlusion with various compressing agents (metal clamps, aluminum bands, rubber bands, etc.). The work of Scarpa, Porta, and other old masters, undertaken chiefly with the view of gradually obliterating the vessels, could not be carried to a successful termination in the state of surgery at the time. At present, the aseptic healing of wounds has placed the behavior of the occluded arteries in an entirely new light, and the result of our own personal investigations, stimulated chiefly by the experimental and clinical work of Dr. W. S. Halsted with his aluminum bands, is convincing of the great value of preliminary occlusion of the blood-vessels with removable metallic bands, as a prophylactic against cerebral complications and peripheral necrosis in other parts of the body. This procedure might well be called "prophylactic occlusion of the arteries" whenever an occluding agent is applied to a blood-vessel with the intention that it interrupt the flow of blood in the vessel provisionally without injuring its walls. This means that if untoward symptoms or signs of peripheral ischæmia should manifest themselves in the

brain or other distal parts, it will be possible, within a reasonable time, to remove the occluding agent (we have in mind a metallic band) and allow the circulation to be restored through the previously occluded artery. This preliminary "test occlusion," with the help of aluminum bands, block tin, or other soft metal, should, if possible, always be tried with local anæsthesia. In dealing with carotid aneurisms, it is important that this preliminary occlusion be made while the patient is fully conscious in order to obtain prompt information of the cerebral effects of the interruption of the blood current in the brain, as these manifestations often appear the moment the occlusion takes place. More often, a period of six, twelve, thirty-six hours, days, and weeks may elapse before the cerebral disturbances show themselves.

Those who are familiar with Dr. Halsted's masterly contributions on this subject will at once recognize the nicety and beauty of the special and ingenious technic with the rolled aluminum band, which he devised in 1905 and has since perfected.³ Unfortunately, however, to roll an aluminum band with perfect accuracy around an artery requires a special curling device which is not always available, and, what is more, requires a very considerable experience in adjusting the band, which all do not possess. Dr. Halsted's chief purpose in using these bands has been to obtain a *gradual* obliteration of the arteries, so that coagulation might be favored in treating the more dangerous aortic and other usually inoperable aneurisms of the neck and splanchnic cavities. His aim has also been to obtain by *gradual* occlusion, a secondary development of the collateral circulation in parts liable to suffer by insufficient vascular supply.

The idea here advocated is that of an *immediate* and *total* occlusion as distinguished from a *gradual* obliteration, with the view of determining the sufficiency of the collateral circulation as a preliminary to a permanent obliteration of the involved vessels. For this purpose, I first applied a simple self-retain-

³ W. S. Halsted: "Partial, Progressive, and Complete Occlusion of the Aorta and Other Large Arteries in the Dog, by Means of the Metallic Band," The Journal of Experimental Medicine, 1909, xi, 373 *et seq.*

ing aluminum band, which occluded the artery by merely flattening it without constricting its walls (Figs. 4 and 5). This band could remain and heal in the tissues as any ordinary aseptic ligature, but could be removed at any time that it might be deemed necessary to do so. With the help of my assistants I experimented with several models, but finally concluded, after various experiments, in favor of the simple, flexible aluminum band which my friend and energetic assistant, Dr. Carrol W. Allen, carried out on a large scale on dogs. The bands may be pressed and kept in place by the fingers. The application of these bands is so simple that they are even easier to apply than a ligature; they stay in place perfectly, are capable of nice adjustment, do not crush the artery, and are tolerated perfectly by the tissues.

We have applied these bands in seven cases in which the subclavian and carotid tracts were involved. The bands have been used either as a prophylactic test of the collateral circulation in dealing with tumors preparatory to extirpation, or in treating aneurisms on the Brasdor plan (Guinard's operation). The chief purpose of the experimental inquiry conducted under my direction by Dr. Allen has been to determine the length of time that an artery, such as the carotid, subclavian, or femoral, could be occluded without permanently damaging or obliterating its lumen. What is the utmost limit of time that an occluding metallic band can be kept in position before permanent damage, leading to thrombosis or embolism, occurs in the intima? What are the changes that occur in the vessel after occlusion has been maintained for a certain number of hours or days, at the time of the occlusion, and after the occluding agent has been removed? What kind of material is best suited for occlusion of the arteries, combining the features of tissue tolerance, facility of application, and ease of removal with the minimum of trauma to the artery?

To answer these questions, the femoral and carotid arteries of dogs were used. Dr. Allen performed 168 experiments on 42 dogs, but this number of experiments was reduced to 43 available results by infections, deaths, and escapes of the animals. These 43 experiments may be grouped as follows:

In 7, the artery was occluded two days; in 14, three days; in 8, five days; in 4, five days; and in 3, six days. In 22 of these cases the vessel and band were excised together at the stated period of observation, and in 21, the clamp or band was removed, the vessel remaining *in situ* to be excised subsequently. After the removal of the vessels, the gross and histological changes were noted and photographs made, showing the condition of the artery at the seat of the occlusion. Three forms of bands were first used, all about as wide as one diameter of the vessel operated upon: (1) a band made of silver wire, in which the wires were held flat and in a single parallel row by soldering the strands together; (2) thin aluminum bands, held in place by clamping the free ends with a lead clip; (3) another aluminum band much thicker than the preceding, and thick enough to maintain a pressure sufficient to occlude the vessel without a clip, when once moulded and adjusted to the vessel with the fingers. The silver wire bands which I had previously used in two distal ligations of the carotid and subclavian were soon discarded for the aluminum bands, and, of these, a thicker kind (No. 14 to 16, Brown & Sharp's sheet-metal gauge)—which retain their hold on the artery without the lead clips—were preferred and have been used since in nearly all the experimental and clinical work. These bands are stiff and are cut into strips long enough to be used as an aneurism needle, by bending and curling one end in the shape of a blunt hook which can be readily insinuated between the blood-vessel and the sheath after preliminary dissection (Fig. 5).

After the band has been carried around the vessel, it is compressed between the fingers of the operator until the pulse on the peripheral side becomes imperceptible. The excess of band which remains is cut off with short, sharp scissors, or preferably with a small wire clipper.

If it should become necessary to remove the band at any time on account of disturbance in the territory supplied by the vessel (cerebral disturbances, threatened gangrene of the toes or digits), the wound can be reopened, and with the point of a sharp instrument inserted between the approximated edges of

the band and slightly twisted, their separation will be accomplished with immediate release of the vessel. Some of these bands have been removed after periods of time varying from four to eight weeks, the specimens having been obtained from patients who had succumbed from the effects of inoperable aneurisms of the innominate, right carotid, and ascending arch. The perfect tolerance of the tissues from suppuration and from secondary hemorrhage was demonstrated in all; the bands remaining encysted in a ring of organized exudate without causing the slightest irritation.

The following are the conclusions arrived at:

1. It is possible to compress a vessel to the point of obliterating the pulse and maintain this pressure for a period of from three to four days, before adhesive or obliterative changes in the intima occur.

2. All the vessels clamped in this manner stood compression seventy-two hours without apparent microscopic change in the intima; some few began to show marked changes in ninety-six hours.

3. There is apparently no reason why, in occluding the great vessels at the root of the neck, chest, and lower abdomen in continuity, these removable bands should not be substituted for the circular ligature, which permanently damages the artery, even when carefully applied. Furthermore, the ligature does not permit of the release of the constriction after a few hours or days of observation without certainty of thrombus formation at the seat of the ligation.

4. In view of the preceding statements, it would seem to be logical to utilize the simple method of occlusion as a preliminary test of the efficiency of the collateral circulation in all regions in which the hyperæmia test, as previously described, is not applicable. A brief statement of this research was presented at the meeting of the Society of Clinical Surgery last November (1909) at Rochester, Minnesota. Since then, more experimental work has been done, and a careful histological study of the specimens removed has also been conducted with the assistance of Dr. Gurd, of the Laboratory of Surgical Pathology of Tulane University.

ANATOMICAL AND SURGICAL DESIDERATA IN THE EXPOSURE AND REMOVAL OF THE PITUITARY GLAND.

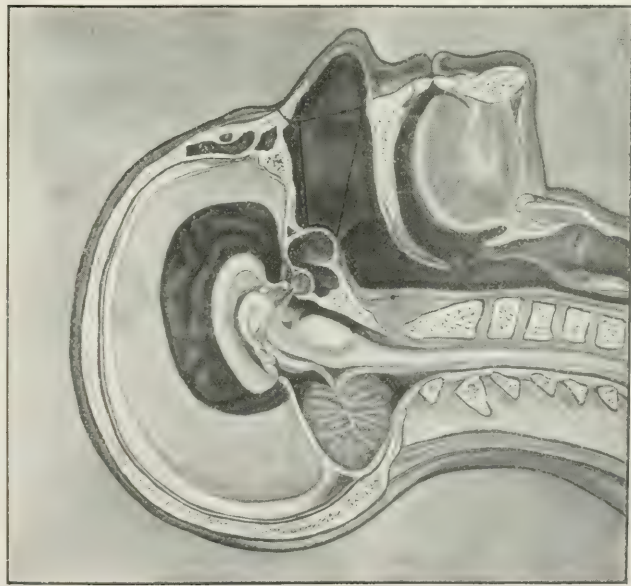
BY A. EMIL SCHMITT, M.D.,

OF NEW YORK,

Instructor in Operative Surgery, Medical Department of Columbia University.

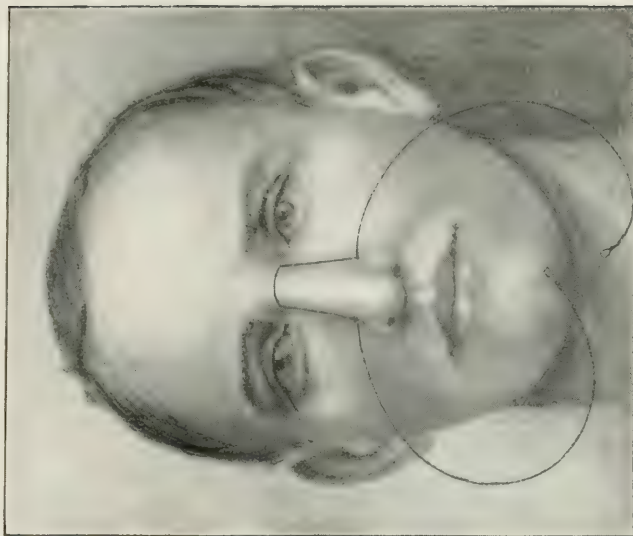
AN anteroposterior section of the head shows that the roof of the nose, when compared to the parts situated anteriorly and posteriorly to it, corresponds, on the one hand, to the depression at the root of the nose, and, on the other, to the uppermost part of the sphenoidal sinus, the anterior wall of which slopes down posteriorly and forms the upper half of the posterior wall of the nasal cavity (Fig. 1). Hence, to expose the sphenoidal sinus, an incision at the root of the nose and from there downward is sufficient and renders opening of the frontal sinus unnecessary. The entire height and width of the interior of the nasal fossæ can be exposed by turning the nose downward. An incision is made on either side, starting below at the widest part of the bony nasal aperture (pyriform fossa) and passing upward to the depression at the root of the nose. These two incisions are united by a cross incision, the scalpel passing through all the tissues down to the bone (Fig. 2). The periosteum of the osteoplastic flap is not interfered with, but that lying opposite it pushed backward toward the face only enough to accommodate the width of a Gigli saw, which is now used, beginning with a cut at the root of the nose to form a groove (which will fix the saw for its downward course) and then continuing through the bone freed of its periosteum until the lower end of the incision has been reached. A retractor, grasping the flap above and drawing it forward, will open a cleft into which a scalpel can be introduced to complete the separation of the cartilage of the septum sufficiently to permit complete depression of the nose, thus exposing the full height

FIG. 1

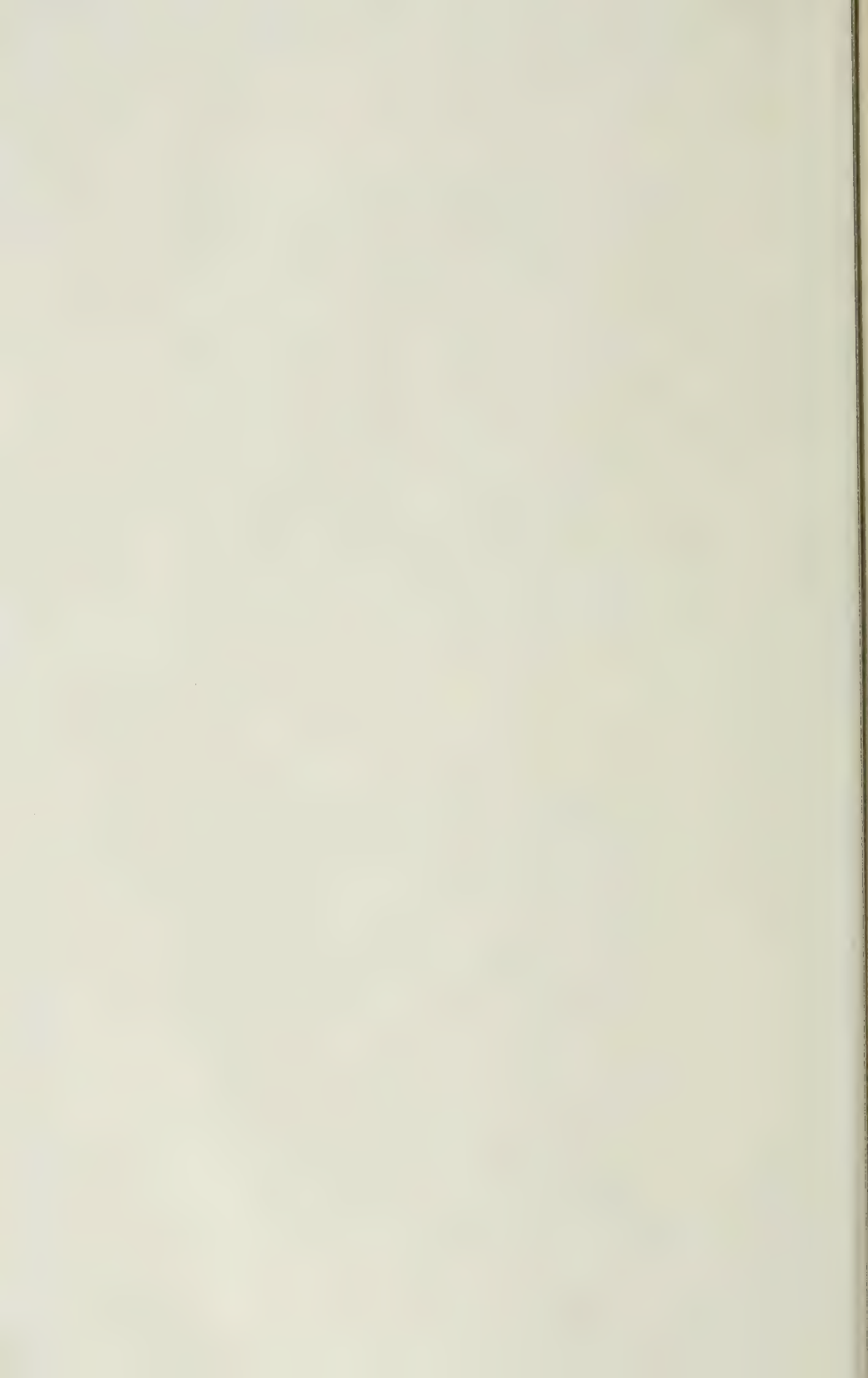


Anteroposterior section of head.

FIG. 2.



External line of incision, showing extent to which bones are divided by the Gigli saw.



and width of the nasal fossæ. The hinge of the soft part, which remains below, contains the terminal branches of the facial arteries, which will nourish the osteoplastic flap thus formed. With curved scissors directed along the roof of the nose, the septum can be severed superiorly and posteriorly along the sloping anterior wall of the sphenoidal sinus. In order to facilitate the grasping of the bleeding vessels, $\frac{1}{2}$ centimetre of the septum should be left standing above while posteriorly it is cut close to the sinus wall. To expose this anterior wall of the sinus, straight scissors should now be used to cut the septum, from below and in front, upward and backward to the middle of the posterior wall of the nasal cavity. A wedge-shaped section of septum is thus removed, producing a funnel-shaped cavity, the opening of which corresponds to the outer border of the nasal cavity and the smaller end to the anterior wall of the sphenoidal sinus, which must be removed. Only in the event of protruding middle turbinals and prominent lateral masses of ethmoid cells should these be interfered with. This is best done by cutting away the turbinals with straight scissors and removing the cell masses by means of a bone curette or forceps. A greater resistance present after ethmoid cells have been removed indicates the orbital plate. The same resistance is met at the roof of the nose and acts as a barrier, preventing exposure of the dura.

After the anterior wall of the sphenoidal sinus is removed by means of chisel and bone-cutting forceps, the prominence on the posterior wall becomes apparent. This prominence is the depression caused by the floor of the sella turcica, and that part of it corresponding to the median line of the skull must be removed to reach the pituitary gland. Oftentimes the septum between the sphenoidal sinuses is irregularly placed to one or other side of the median line of the skull, or starts on one side or other above and runs to the opposite side below; frequently it is entirely absent. Therefore, to expose the pituitary body, it is essential to choose the median line of the skull, not permitting the irregularly attached sphenoidal septum to detract from removal of the midportion of the prominence

on the posterior wall of the sinus. This should be confined to the central portion to avoid injuring the cavernous sinuses and carotid arteries on either side, and a button about half a centimetre in diameter should be removed with a trephine or a long-handled gouge, its concave surface directed toward a central point. For a decompression operation to relieve the tension of a tumor, more of this posterior wall must be removed. After the bone corresponding to the floor of the sella turcica has been removed, the cavity is recognized by probing, the resistance of the posterior wall of the sella turcica (*dorsum sellæ*) indicating the exact location of the cavity sought for. Removal of the gland can be accomplished by means of a long-handled scoop or curette.

The purpose of the procedure having been accomplished, the nose is brought back into place and secured by several sutures for the deeper tissues and periosteum and finally some for the skin. In this way the greater part of the interior of the nasal cavity remains intact and the part sought for is completely exposed, illumination of the depth of the cavity being accomplished by means of a head light or an electric pencil directed to the field of operation.

THE TREATMENT OF X-RAY ULCER.

BY RAYMOND C. TURCK, M.D.,

OF JACKSONVILLE, FLORIDA.

X-RAY ulcer cannot be classed pathologically as true ulcer. The lesion is exceedingly complex and partakes of the characteristics of a tissue necrosis, a gangrene, and a fibrosis.

Burdick, who has had a large experience in the treatment of this condition, believes it to be a white gangrene. The lesion, if left to itself or if treated by any of the ordinary methods, follows a fairly typical course, varying only in the length of time covered by the different stages.

There is, first, a slight dermatitis or erythema at the site of the exposure; this appears usually in from two to three days, though cases are recorded in which the primary dermatitis did not develop until the end of the third week. Vesicles and pustules then appear in the erythematous area, with pigmentation and loss of hair. Ulceration and sloughing soon begin in the centre of the inflamed patch and extend concentrically outward. After the superficial necrotic tissue has sloughed off, a foul, dirty gray ulcer is left, the base of which is composed of a leathery fibrous tissue, exuding a foul, viscid, yellowish secretion. If operative measures are not resorted to, this condition may persist for months or years; may terminate fatally; may become the seat of an X-ray carcinoma, or after a varying period of time, may cure spontaneously by sloughing away of the thick fibrous base and healing of the resultant wound by the ordinary process of granulation. The site of an ulcer spontaneously healed is always tender and irritable, and is frequently the seat of small necrotic areas, which in turn may slough, granulate, and eventually heal.

The two most striking features of an X-ray ulcer are its absolute resistance to any ordinary medicinal treatments or

dressings and the excruciating pain which accompanies it. Burdick thus described the pain of fairly typical cases:

"The pain from an X-ray burn is very characteristic. It has no other analogue in medicine. We may have the smarting, itching, and radiating neuralgia pains for a few weeks, until it is evident that necrotic tissue is present, when the pain becomes an agony. . . . It will last ordinarily as long as the gangrenous tissue is in the wound and stop upon its removal."

"After the wound is cleaned up by curettement, relief from pains may last for a few days or weeks; eventually the pains recur with this variation: they are paroxysmal in character, coming on several times in twenty-four hours and lasting for an hour or more, when they leave as suddenly as they came. The patient is perfectly comfortable between the attacks and feels as well as he does in general health."

Emphasis should be laid upon the fact that the pain ceases and healing begins only after the fibrous or gangrenous base of the ulcer has sloughed away, or after it has been cut out.

No form of applications, ointments, powders, wet dressings, or local anæsthetics exerts the slightest influence upon a well-developed X-ray ulcer, either in the mitigation of pain, or in the healing process. Indeed, any kind of medicated application seems but to aggravate the patient's pain, and morphine hypodermatically must always be employed.

In the case herein reported it was determined to thoroughly remove all of the fibrous base of the ulcer and skin graft the surface after new granulation had formed.

I proposed to use the method of skin grafting reported by Dr. John S. Davis in *ANNALS OF SURGERY* for March, 1909. Davis advises the application of a splint after the grafts are in place. His splint is made from a coarse curtain mesh, which after being washed and dried, is soaked in a solution of pure gutta-percha 30 parts, chloroform 150 parts. After the chloroform evaporates the curtain mesh is left with some stiffness. The mesh is sterilized by washing in a 1 to 1000 solution of bichloride, and is kept permanently in

a jar of the same solution. In Davis's method, after Thiersch grafts are in place, the splint is rinsed in salt solution and applied, lapping well over the edges of the grafted area, and fastened in place with adhesive straps which should not extend upon the raw surface. The advantage of this splint lies in the fact that the grafts do not stick to the dressing nor does the granulation tissue grow into the mesh. Davis recommends a first dressing in from thirty to seventy-two hours; the gauze next to the mesh being well soaked in salt solution before removal, and care taken that the mesh is not pulled up from the grafts. The grafts may then be irrigated and a fresh dressing applied over the mesh.

Unfortunately, I was unable to procure any pure gutta-percha in time to prepare this splint, so I used a curtain mesh soaked in a 5 per cent. solution of celloidin and sterilized, after drying, by immersion in a 1 to 500 bichloride solution. While this worked out very satisfactorily, yet I believe the splint prepared with gutta-percha to be much superior.

CASE I.—The patient is a white male, age thirty-six. In October, 1908, he contracted syphilis with a well-defined chancre. The secondary eruption appeared in December. In the latter part of December, 1908, he had an attack of acute jaundice, which confined him to his bed for a month. This culminated in localized pain in the right iliac fossa, which was diagnosed as acute catarrhal appendicitis.

In February, 1909, he appeared at the office of a specialist in electrotherapeutics, stating that he had read in New York papers of the benefit of X-ray treatment for catarrhal appendicitis, and asked for treatment. He was advised regarding the danger of a burn, particularly since he was suffering with secondary syphilitic eruption, but he insisted upon taking the X-ray treatment, if there was a possible chance of relieving him of the pain. He was further advised that the chances of benefiting appendicitis with the X-ray were small.

Under protest, however, the specialist, a skilled and experienced X-ray operator, consented to give him a few treatments and to carefully watch the results. He was given for four weeks tri-weekly exposures, each of five minutes' duration, with the

tube placed fourteen inches from the abdomen. Registered penetration No. 6. The pain in his right side subsided and after an interval of a week he was given three more four-minute exposures with the same tube, same distance and penetration. Two weeks after the last exposure the first symptom of a first degree burn appeared. This was treated with normal salt solution. The erythema extended from his groin to within one and one-half inches of his navel, causing him but little pain or discomfort at that time. The area of dermatitis was apparently disappearing when a necrotic area, about two and one-half inches in diameter, appeared in the centre. After the necrosed skin had sloughed, this area assumed a tough, leathery appearance and became very painful. He was put to bed and local applications of ointments, powders, and wet dressings applied. The pain became intense, necessitating from one-half to one and one-half grains of morphine per day. The ulceration gradually became deeper and wider in area, with pains apparently increasing in proportion to the spread of the necrosis.

At this time, April, 1909, the patient was referred to me for treatment. I found a foul, sluggish ulcer about five inches in diameter situated upon the right side of the abdominal wall, extending from a line an inch above the navel nearly to Poupart's ligament. I first did a superficial curettage under local anæsthesia on April 28, 1909. The pain was terrific. A formadine dressing was applied. Following this there was some epithelial growth from the skin edges; no granulation, however, upon the scar tissue.

There being no improvement and the pain still continuing, he was advised that a thorough removal of the necrotic area, with subsequent skin grafting, offered him the best chance for recovery. He was accordingly sent to St. Luke's Hospital, and on April 29, 1909, under ether anæsthesia, the edges of the ulcer were thoroughly curetted and the firm, leathery base of the ulcer was entirely removed down to normal bleeding tissue. The fibroid base was in some places nearly three-quarters of an inch in thickness, and extended in some instances well down into the rectus and external oblique muscles. Strands of fibrous tissue were also radiating from the main fibrous body into the fascia and musculature. Hemorrhage was controlled by hot saline packs. The wound was dusted thickly with aristol. On the

second day a wet boric dressing was applied and continued until the skin grafting operation, May 6, 1909.

Four hours before the grafting operation, the boric dressing was removed, the wound was irrigated, and a wet dressing of 1 per cent. formalin solution applied. The formalin dressing was removed after anæsthesia and the granulating surface irrigated with normal salt solution. The granulation tissue was then lightly shaved with a razor, and after controlling all oozing with hot saline packs, the area was covered with small Thiersch grafts taken from the patient's thighs. The wound was then dressed with the celloidin meshed splint. Over this were placed several layers of gauze saturated with normal saline solution, and the whole covered with rubber tissue.

There was a great deal of secretion. The dressings were removed down to the splint on the fifth day and wet boric dressings applied. Secretion was profuse. The splint was removed at the end of the tenth day and the grafted surface dressed with sterile boric ointment and gauze. The ointment was warmed so that it would flow in liquid form. It was then poured upon the grafts and allowed to harden to its normal consistency. This treatment was continued until May 24, 1909, when the area was nearly covered in and doing nicely. On June 15 the wound was entirely healed and the patient left the hospital. The boric ointment application was continued until August, 1909; the patient, however, began doing light work after July 1. The scar has given no trouble and has been at all times perfectly solid. There has been no pain since the first removal of the fibrous tissue.

Histopathologic Findings.—Vertical sections were made from the centre and margins of the ulcer base.

All layers of the epidermis as well as the papillary layer of the skin were absent.

Upon the upper surface a few chromatophores and numerous polynuclear leucocytes were found.

Blood-vessels and lymph-channels were few and atrophic. Occasionally the remains of a sweat duct was observed, the epithelia atrophic or lacking; here and there desquamated and blocking the lumen. The fibrous sheaths of the ducts were much thickened.

There were no hairs, hair follicles, nor sebaceous glands.

Just below the surface, and about the atrophic vessels, sweat-glands, and ducts, there were numerous dense cell infiltrations.

These cell infiltrations were made up of plasma cells, polynuclear leucocytes, and small lymphocytes, the latter predominating.

The collagen bundles were in part swollen and translucent, in part replaced by old white fibrous tissue with slender pycnotic fibroblasts, their nuclei often irregular and distorted.

Areas of infiltrating cells (mainly small mononuclears) and much glassy or adult fibrous tissue were found in the depths of the specimen.

The intracellular tissue between the fat cells of the subcutis was much thickened, and new fibrous bands could be seen extending downward and in all directions.

The few vessels showed obliterating changes, both media and adventitia being greatly thickened, and the vessel lumen being decreased irregularly by the distorted endothelia.

The muscle nuclei of the arterioles were pycnotic and distorted.

The perineurium of the nerve-fibres was also thickened; there was in addition a chronic interstitial fibrous proliferation in the nerve, with a few polynuclear leucocytes in the nerve-fibres.

The fibrosis was general, disposed in trabecular and retiform arrangement.

POSTERIOR GASTRO-ENTEROSTOMY, THREE YEARS AFTER ANTERIOR GASTRO- ENTEROSTOMY.

BY M. A. FAUNTLEROY, M.D.,

Surgeon in the United States Navy.

THIS man, whose case is given below, has the unusual distinction of possessing two gastro-enterostomies, one anterior and one posterior, the latter having been performed three years after the former.

H. A. W., unmarried, age 22 years and eleven months. Case paper No. 275, U. S. Naval Hospital, Philadelphia, Pa. Admitted from the U. S. S. *Lancaster* on October 8, 1910, with a diagnosis of gastric ulcer.

Has always been in robust health up to the age of seventeen, when he began to have a more or less continuous localized epigastric pain in the midline. He dates this trouble from a time when he was lifting a heavy weight, causing, as he states, a lump to appear to the right of the umbilicus, which, however, shortly passed away and has never reappeared. Pressure over the epigastric region intensified the pain, and at this time the pain was present at practically all hours of the day and night so that he could not sleep.

He was transferred to the U. S. Naval Hospital, Annapolis, Md., in April, 1907, with a diagnosis of gastric ulcer, having vomited blood very copiously just before transfer to the hospital. Nothing further is noted on the patient's case paper at this time except that the pain continued, requiring at times morphia, and that he was becoming progressively thinner. In July, 1907, an anterior gastro-enterostomy was performed at the U. S. Naval Hospital, Annapolis, Md., and a Murphy button was used to effect the anastomosis. There was marked improvement after the operation, there being a cessation of all pain, and when the patient was discharged to duty four months later he had gained 36 pounds. Shortly after he had been discharged he contracted

scarlet fever, from which he made a complete recovery. The patient's case paper further states that at the time of his discharge to duty after operation the Murphy button had not been passed, and that several skiagraphs taken at this time showed the button in position.

Patient was free from all symptoms until the latter part of September, 1910, when the pains began to return about an hour after eating meals; these pains were relieved by taking bicarbonate of soda. On the morning of October 8, 1910, there was a moderately severe hæmatemesis and he was transferred to the U. S. Naval Hospital, Philadelphia, Pa., for further treatment.

On admission to this hospital he was slightly emaciated, but with fair color. There was no pain or tenderness even on deep pressure in the epigastric region. On the evening of the day of his admission he had a rather copious hemorrhage from the stomach and another on the evening of October 9. In the early morning of October 11, there were two very copious hemorrhages, and a stool passed at this time was black and tarry. There was still no pain and the patient's belly was abnormally flat. The vomited blood in each instance was markedly acid. At this time there was marked pallor and weakness with a pulse of 126, and immediate operation was decided upon and the patient prepared accordingly.

Operation.—Ether anæsthetic. Before the anæsthetic was started the right median cephalic vein was opened and salt infusion begun. This was kept up during the entire operation, 2200 c.c. being introduced in all. An incision was made to the right of the old scar and the abdomen rapidly opened, from the ensiform cartilage to eight inches below. On opening the abdomen and viewing the parts, there was seen a more or less conglomerate mass, consisting of omentum and small intestine which seemed to be glued together over the region of the stomach. These adhesions were carefully and slowly broken up with the aid of a gauze pad, and only once was it necessary to use the scissors. In this latter instance there was a broad, dense, as well as short, band of adhesions which anchored the upper anterior part of the stomach to the diaphragm. This was carefully snipped away and a few bleeding points ligated with small silk. On the removal of this band of adhesion the stomach

was more plainly visible and allowed of much freer manipulation. After about 20 minutes of separating adhesions, the former anterior gastro-enterostomy was plainly made out and the limbs of the gut identified.

The entire stomach was carefully palpated with the idea of possibly locating the indurated margin of an ulcer, but no spot could be incriminated as a possible bleeding point. The stomach was about three times as large as normal, and the pylorus and upper duodenum were dwarfed and thickened. It could be plainly seen from the high position of the former anterior anastomosis that the stomach was not being drained properly since clotty blood could be felt through the stomach walls below the level of this anastomosis. In view of the above, it was decided to perform a posterior gastro-enterostomy in the most dependent part, including a part of the greater curvature as recommended by the Mayos. The greater omentum was ligated and removed for a distance of three inches along its attachment to the greater curvature, and the lines of the gut leading from the old anterior anastomosis were selected to form part of the new posterior anastomosis. An opening was made in the gastrocolic omentum by blunt dissection, and the lower posterior surface of the stomach pushed through from behind. Moynihan's clamps were used, and a three-inch incision was made in both stomach and intestine after the clamps had been secured in position and after the posterior seromuscular silk suture had been placed. The intestinal and gastric mucous membrane was trimmed and sutured together with silk, and the posterior seromuscular suture continued around to form the anterior seromuscular suture in the usual way.

After the patient had recovered from the ether he was placed almost in Fowler's position, with the idea of encouraging the complete drainage of the stomach through the large new opening. The after-treatment consisted of nothing by the mouth for five days, during which time the only nourishment he received was 500 c.c. of salt solution by rectum every six hours. At the end of this time small feeds of peptonized milk, chicken broth and albumin water were allowed every two hours. These were borne well and gradually increased, until at the present time (38 days after operation), the patient is practically on full diet and has been walking out in the hospital grounds for the past

week. The first few days after operation the patient complained of great thirst, but with this exception and a slight post-operative rise of temperature he has not had an untoward symptom. His bowels move regularly and are of normal color and consistence.

This case illustrates in a striking manner the importance of securing prompt and efficient drainage where copious hemorrhage from the stomach is a prominent feature, and it is believed that an early operation is indicated where the first few days of medical treatment apparently have no effect on the outpouring of blood in the stomach. The gastric juice drains off immediately and does not digest an existing ulcer or denuded surface, and it is also believed that there is a contraction of the organ with a consequent arrest of hemorrhage. No Murphy button was found at the site of the old anastomosis and it was doubtless passed without the patient knowing it.

NON-PROSTATIC URINARY RETENTION OF THE SENILE BLADDER.*

BY MARTIN W. WARE, M.D.,

OF NEW YORK,

Adjunct Surgeon in the Genito-Urinary Service, Mt. Sinai Hospital.

WHENEVER we are confronted with an aged patient afflicted with dysuria characterized by complete or incomplete retention with or without incontinence, pollakiuria, increased ardor urinæ, or retarded urination, we are wont in text-book-like fashion to placate the lesion, either as an intravesical mechanical obstruction, or attribute it to a lesion of the vesical central nervous system. An ever-increasing report of cases, which, however, do not fit in either category, is very evident from a perusal of the literature, and warrants a consideration of this subject, which was prompted by an experience with such similar cases.

J. B., No. 115,543, June 15, 1910, aged seventy years, was admitted to the medical service of Mt. Sinai Hospital for emphysema and myocarditis. During the two weeks that he was an inmate, it was noticed that he was incontinent. For this dysuria, he was referred to the Genito-Urinary Service, with a tentative diagnosis of hypertrophied prostate.

Status Præsens.—A very aged appearing man, blunted sensibility, though conscious, and somewhat deaf. The vessels generally atheromatous. Heart sounds dull and muffled and distant, and an occasional systolic murmur at the apex.

Rectal Examination.—External hemorrhoids. Palpation revealed a prostate not enlarged but moderately firm and not tender. Percussion of the abdomen showed the bladder dulness reaching three finger-breadths above the pubis. The patient was unable to void. A soft (Nélaton) rubber 20 F. catheter entered easily, and 720 c.c. of clear urine were withdrawn.

* Read before the Genito-Urinary Section of the New York Academy of Medicine, October 19, 1910.

Cystoscopy.—Bladder distention 200 c.c. Diffuse trabeculation. No evidence of any prostatic enlargement and the ureters normally located. Urine in 24 hours, 1200 c.c., amber, faintly cloudy, 1016 sp. gr., faint trace of albumin; 1.4 per cent. urea (16.8 Gm.) in 24 hours. Occasional hyaline casts, few leucocytes, and some erythrocytes.

Diagnosis.—The trabeculation directed our attention to the likelihood of an existing tabes. The counsel of the neurologist, Dr. I. Abrahamson, was sought on this point in question. He reports: knee-jerks present, pupils irregular but they react. Achilles reflex present. Sensations normal in legs and body. No tabes. Furthermore the complement fixation test by the Wassermann and Noguchi systems was reported negative by Dr. J. Kalski, thus eliminating spinal syphilis.

Treatment.—An indwelling catheter was located at first for the night; following its removal during the day, the retention continued to be a feature alongside of the incontinence. Then the catheter *à demeure* was placed permanently for five days with daily washings of silver nitrate 1:3000 to prevent infection, up to now foreign to the viscus. Upon the removal of the catheter on the sixth day, the patient voided in small quantity with much effort.

CONCLUSION: The best explanation we had to offer in the absence of prostatic enlargement and failure to establish the existence of a nerve lesion was that the bladder suffered changes like unto the heart and kidneys in consequence of senility.

In support of such a view, the following case, by way of clinical proof, is cited: In *Lyon Medical*, March 16, 1890, Daniel Molieré¹ reports under the caption "Dysurie Senile" peculiar disturbances in the urination of the senile, which have much in common with prostatic hypertrophy, but they are encountered also in the absence of any gland involvement. He attributes the sudden onset of retention (dysuria) and increased ardor to an affection of the vesicoprostatic plexus.

In the same year, 1890, Ultzman,² in the series of the *Deutsche Chirurgie*, says: "In advanced age the urinary insufficiency, even if a marked paresis is not demonstrable, is

nearly always the rule. That prostatic hypertrophy peculiar to advanced age constitutes a mechanical obstacle is well established. Yet we would err greatly were we to assign all cases of senile insufficiency of the bladder to this affection. Often the cause of insufficient emptying of the bladder rests upon senile changes (atrophy of the bladder)."

Launois³ in 1894, under the guidance of Guyon, says, that in the retention of the aged, arteriosclerosis is a factor of the first importance and the lesions of endo- and periarteritis involve not only the prostate but extend to the bladder and kidney.

In 1899 Guyon⁴ gave to us his contribution on "Prostatisme Vesicale," also spoken of as "Prostatisme Senile," and above all perpetuated as "Prostatisme sans Prostate." In a clinical sense he considers that senile dysuria is dependent, not invariably on prostatic obstruction, but is a resultant of many factors which have a common cause; this should not be styled arteriosclerosis but a trouble of nutrition which may be brought on by the inroads of years or by the failure of the organism in consequence of intoxication or premature wear and tear.

At this stage it may be opportune to introduce the report of an undetermined case of senile dysuria observed with Dr. H. Goldenberg in his service and to whom I wish to make my acknowledgments for consent to report this interesting case.

G. P., No. 110,633, admitted Nov., 1909, aged fifty-five. Five weeks in medical service with pneumonia; while there, developed retention. Habit of voiding every two hours day and night for two years. Never any retention or incontinence at night until two and a half weeks ago. Since then, dribbles continuously at night. Sexual impotence for three years. No gonorrhœa or syphilis; temperate alcoholic habit; 800 c.c. urine, purulent, withdrawn.

Cystoscopy.—Fundus heavily trabeculated, few small diverticula. Mucosa injected. Trigone and ureter orifices normal, except they were so close together that they could be seen in the same field. Ureter peristalsis visible. *Absolutely no prostatic enlargement*. Sphincter margin a horizontal line. No sign

of middle lobe. Rectal sphincter relaxed. Prostate small, atrophic. Following instillation of AgNO_3 , 1 per cent., into deep urethra, $5\frac{1}{2}$ oz. of a very good stream voided. Residual urine thereafter 2 oz.

Dr. B. Sachs reported: pupils sluggish; knee-jerks present. There is a possibility that the retention is of senile origin.

Endoscopy (Goldschmidt).—Flattened colliculus. Nothing of the nature of a valve seen at the internal ostium.

Capacity Test.—350 c.c. boric solution let into the bladder; patient, while pressing on the abdomen, voids (bladder-expressibility of Zuckerkandel) 150 c.c. After injecting AgNO_3 , 1 per cent., voids the remnant of 150 c.c. in a very good stream. Incontinence is not overflow but due to atony of the bladder detrusor or weakness of the muscular sphincter prostaticus, while in the daytime, the patient has control over his bladder by voluntary control of his sphincter externus. Urethra seven and a half inches in length and absolutely no resistance to catheter at introitus of bladder. No appreciation of 2 per cent. AgNO_3 in the posterior urethra. Extremes of cold and heat not complained of or differentiated. To determine whether dribbling would follow complete emptying of the bladder, this latter was done upon retiring. None the less, dribbling continued throughout the sleep, proving relaxation of the sphincter at night. Cystitis improved some; other symptoms persisted. Discharged at first with diagnosis of atrophy of prostate and senility. Subsequently asked to enter for another neurological examination. Dr. B. Sachs this time expressed himself as believing that there might be an arteriosclerosis of vessels affecting the circulation of the cord.

In 1901 Ciechanowsky,⁵ by his anatomical researches, showed the influence of age on the bladder muscle. Between 40 and 50, the muscle constituted nearly three-quarters of the bladder wall, whereas amongst the aged it was hardly two-thirds or only half. And he, too, says that senile debility alone is not a question of years, that premature age can attack the bladder as well as other organs and is aided by alcoholism and other intoxications.

In the following year, 1902, Halle and Motz⁶ also admit the influence of age in these cases of "prostatisme sans pros-

tate" in causing a relative atrophy of the muscular tissue; and that sclerosis and fatty degeneration of the bladder wall are secondary to infections, intoxications, etc. On the other hand, they emphasize that total atrophy is rare, and that the quantity of muscle is superior to that which exists in normal bladders, and that as in true enlargement, muscular hypertrophy is the essential lesion.

So, too, Zuckerkandel,⁷ 1904, says: "Senile changes or chronic distention are capable of seriously damaging the bladder muscle in its function. There are incurable forms of retention amongst the senile, in whom no mechanical or nervous cause can be determined. Whether an atrophy or degenerative muscle is out of play is not known."

In the meantime, the removal of enlarged prostates with complete restoration of bladder function had set at naught the pronouncements of Guyon and Thompson, that the atony was irreparable.

Within the same period, Motz and Arese⁸ proved, in prostates without a prostate, that the extirpation of a gland, which at least in appearance could not form an obstruction to emission of urine, would restore function lastingly, so in persons who had been a long time afflicted with complete retention. They consequently insisted that it was not a muscular degeneration which was the primary cause of the bladder atony, and, what is significant, the bladder in such cases was no more deficient in muscle than in cases of actual hypertrophic prostate.

We, too, have experienced the complete restoration of bladder function after prostatectomy in a number of cases that proved to have small prostates at operation. One such case, however, with an unfavorable outcome is herewith narrated:

J. G., aged sixty-seven, No. 112,844, Jan., 1910. Denies gonorrhoea and syphilis. Alcoholic habit temperate, obstinate obstipation. Bilateral rupture (?). Within the last two weeks these hydroceles (ruptures?) grew larger, coinciding with which urinary frequency and ardor increased. Soon complete retention set in, necessitating catheterization for twelve days prior to admission. Great thirst.

Status Præsens.—Pale, flabby, very ill, low tension, pulse regular, no murmur, signs of emphysema. Abdomen: rigid, distended from corporastasis. Tenderness over suprapubic area in which region bladder dulness extended half way up to the umbilicus. Genitals: distention of scrotum by the two large hydroceles on either side caused disappearance of penis, and owing to tension of large amount of fluid, the testes were difficult to discern. By rectum: prostate felt, but not considered enlarged. Soft catheter enters bladder easily, 900 c.c. urine withdrawn; alkaline, 1012, purulent.

For three days catheterization was performed twice a day without any return of function, and then for one week the indwelling catheter brought no betterment. Pyuria precluded cystoscopic examination. On the eleventh day, the bladder was opened by a suprapubic incision. A trabeculated bladder felt, and a small, hard, annular prostatic enlargement felt, with very small posterior lip about one-half inch in height. Finger gripped at introitus. Another week of drainage and then a small overhanging lip was removed. It measured $1 \times \frac{3}{4}$ cm. Dr. F. Mandelbaum, pathologist, reported that the specimen was hypertrophic, not carcinomatous. At the end of six weeks, the suprapubic fistula was completely closed. The cystitis necessitated treatment, whereupon the introduction of a catheter, Nélaton F. 18, meeting with obstruction, a sound was occasionally passed. The patient was able to void 150 c.c. of AgNO_3 introduced into his bladder. After five months, the fistula of bladder opened again and has done so on and off eight months after operation. He has retained all of his symptoms. Residual urine 8 oz., can void 8 oz., and urine is purulent.

Cystoscopy.—Nitze enters easily. Bladder trabeculated, and near the outlet two translucent folds are to be seen.

EPICRISIS.—But for the findings of the pathologist that the glandular tissue removed and examined was hypertrophic, we would as a last analysis place this case as an instance of atrophy of the prostate, to which diagnosis we are disposed by the cystoscopic findings of folds in front of the neck of the bladder which are described and pictured by English⁹ in his description of atrophy of the prostate. These three cases narrated can at the best only be placed in a category of retention without mechanical obstruction.

This very topic was the order of the day at the First International Congress of Urology at Paris in 1907. On this occasion, Albarran¹⁰ exhaustively treated this subject. His introductory remarks were to this effect: "Until recently, it was the belief that the mechanical obstruction of prostatic hypertrophy alone could not explain retention, and the onus was put on the degenerated muscle. We know now that this also has been abandoned." He then proceeded by numerous examples, experimental and above all clinical, to elaborate the theory promulgated by Janet¹¹ five years previously as "Inhibition Vesicale." Thus Albarran says: "When the neck is free and the prostate of small volume, one cannot quite think of a cervical urethral obstacle which could awaken the possibility of a retention, independent up to a certain point of the macroscopic form of hypertrophy. Reflex inhibition of the bladder causing retention is a part of prostatic hypertrophy and is present in all forms of prostatitis, acute or chronic." In this category he places "the cases of retention accompanying prostatitis described by Janet and Genouville (*l. c.*), and the form of prostatitis cystoparetica of Goldberg,¹² Notthaft (*l. c.*), and the chronic hypertrophic prostatitis of Albarran (*l. c.*). At times these prostatites go on to cure by fibrous transformation and then in turn the reparative process gives rise to retention without creating a veritable obstruction. Such he believes to be the case in Chetwood's "Contracture of the Neck of the Bladder," in which there is neither hyperplasia of the muscular elements of the sphincter nor of the adenomatous tissue, but rather a fibrous stenosis of the vesical orifice (most often of gonorrhœic origin), a description identical with that of Keyes, Sr.¹³ Furthermore, there is neither enlargement of the prostate nor increase in length of the canal. Albarran (*l. c.*) says he himself has seen similar cases only recognized at operation. Strictures of the urethra of large calibre are known to give rise to complete or incomplete retention.

From all these facts it is necessary to conclude that in small hypertrophied prostates, hypertrophic prostatitis, and large strictures, the obstacle is insufficient to explain the retention for which one cannot make the spasm responsible when

the catheter shows it to be absent. Therefore it is necessary to admit, perhaps an inhibition of vesical contractility, perhaps the loss of the inhibitory power we possess over the external sphincter, *i.e.*, to relax it.

In conclusion Albarran (*l. c.*) adds: "We could furthermore give numerous observations of vesical retention, complete or incomplete, in patients beyond fifty years of age in whom the cause of vesical insufficiency cannot be disclosed on the aforesaid or any other ground. *They are the prostatics without prostates.* Several present a slight prostatic lesion, and one could attribute their retention to phenomena of inhibition, arising from the prostate, but in others the prostate is healthy." Then follows the recital of a case like unto the last one mentioned by us. The history is as follows:

Patient, aged sixty. Since two years difficulty of micturition increased until he came with complete retention. For six months he has been instilled. Minute examination of the urinary apparatus and of the nervous system reveals nothing abnormal. The prostate in particular is normal. No projection in the neck by cystoscopy. The patient demanded prostatectomy in spite of advisement to contrary. A suprapubic operation was performed for the removal of the prostate. Microscopic examination, healthy gland. Recovery from operation, but complete retention persists.

In 1909, Asch,¹⁴ of Strassburg, at a medical meeting reported that he saw five males afflicted with retention, dribbling, and tenesmus, in whom no mechanical obstruction or central nerve lesion could be made out. By cystoscopy the bladder was made out to be trabeculated. These trabeculæ are due to the secondary muscular hypertrophy, following a primary degeneration of the muscle, or the degeneration is traceable to diseased nerves of the bladder or of the ganglionic centres of the bladder. A trabeculated bladder is therefore of myogenic or neurogenic origin. A second variety of trabeculated bladder is due to extension of destructive inflammatory processes, associated with scattered areas of true muscular hypertrophy. In a third class of cases with above symptoms, four males, the bladder is void of trabeculæ but incapable

of concentric contraction. These bladders, infiltrated in part, atrophic in others, have to be differentiated from carcinoma; they are likely inflammatory.

Within this year Casper,¹⁵ 1910, reported a case of a man sixty-eight years of age, with unusually protracted retention (complete), of eight years' standing, in whom there was no urethral or vesical obstruction, and an absence of nerve lesions. He regards the case as one with degenerative bladder changes characterized by sclerosis (Guyon).

In 1909, in their recent text-book, Desnos and Minet¹⁶ add their testimony thus: "We meet with senile individuals in whom urination is hesitating or slow at the beginning, with a diminished stream and increased frequency at night. They are impressionable to all congestions; later on they will be subject to retention and incontinence and act as veritable prostatitics. They present, however, neither hypertrophy of the prostate nor any modification of the neck, but the muscle is degenerated."

CONCLUSION.

From the history of cases instanced and elucidated by the authorities cited, we must admit that a class of cases exist in which the stigma resides essentially in the muscle insufficiency, though what is the fundamental cause for this atony remains undetermined. For we have to choose from a muscle degenerated by arteriosclerosis, or sclerosed secondary to infections, or primarily atrophic following a peripheral nerve lesion, or secondarily so, as an atrophy that follows every hypertrophy. Tersely stated, the atony is of vascular, myogenic, neurogenic, or infectious origin. Finally, in some cases all these factors operate towards the same end.

It is therefore commendable in singling out cases for operation to take cognizance that these borderline cases be not subjected to operations, and that the cystoscopic examination be resorted to as a routine in aiding to determine for or against this.

There then but remains the cases of contracture of the neck of the bladder *in so far as they occur in the aged(?)*. Could they be diagnosticated *by other than autoptic findings*

at the moment of opening the bladder, they would be suitable for operation along the lines laid down by Chetwood. Albarán (*l. c.*) admits encountering these cases *at operation only*.

This interesting chapter in urinary retention is *sub judice*. Consequently operations of any kind undertaken therefor can only be vindicated as being exploratory. The alternative of operation is a catheter life.

As a befitting conclusion to this essay, I cite the words of our esteemed nestor of American urology, Dr. Jno. W. Gouley¹⁷ from his recent "Surgery of the Genito-urinary Organs:" "Vesical dilation, even when there is no obstruction to urination, is not uncommon among elderly men. Post-mortem examination of such bladders showed the absence of any mechanical obstruction."

LITERATURE.

¹ Moliere: Dysurie Senile, Lyon Medical, 16 March, 1890.

² Ultzman: Krankheiten d. Blase, Deut. Chir., 1890, p. 348.

³ Launois: De l'Atrophie de la Prostate, Ann. d. Malad. des Organes Genito-Urinaire, 1894, p. 121.

⁴ Guyon: Prostatisme Vesicale, Ann. d. Mal. d. Org. Gen., Fevrier, 1899.

⁵ Ciechanowsky: Quelques Aperçus sur le Prostatisme, etc., Ann. d. M. d. Org. Genit., 1901, p. 536.

⁶ Halle et Motz: Contribution a la Anat. Path. de la Vessie, Ann. d. M. d. Org. Gen., 1902.

⁷ Zuckerkandel: Handbuch d. Urologie, 1904, vol. i, p. 720.

⁸ Motz et Arese: Notes sur les Vessies d. Prostatiques sans P., Ann. d. M. d. Org. Gen., No. 24, 1903.

⁹ Englisch: Ueber Kleinheit d. Vorsteherdruese, etc., Zeitschr. f. Heilkunde, 1901, H. 12.

¹⁰ Albarran: Retentions D'Urine sans Obstacle Mecanique, Premier Congres, Internationale d'Urologie, 1908, p. 299, et seq.

¹¹ Janet: De l'Inhibition Genito-Vesicale, Assoc. Francaise d'Urologie, 1902, p. 294.

¹² Goldberg: Prostatitis Chronica Cystoparetica, C'b'td Harn u. Sex. Org., 1906, p. 531.

¹³ Keyes, Sr.: Contracture of the Neck of the Bladder, Surgical Diseases of Genito-Urinary Organs, Appleton Series, 1904, p. 273.

¹⁴ Asch: Die Erkrankungen d. Blasenmuskulatur, Aertzte Verein Strassburg, Deutsche med. Wochenschr., 1909, p. 1293.

¹⁵ Casper: Ungewoenlishe Faelle v. dauernder Harnverhaltung, Berl. med. Ges., Deut. med. Wochschr., 1910, p. 385.

¹⁶ Desnos et Minet: Traite des Mal. d. Voies Urinaires, 1909, p. 405.

¹⁷ Gouley: Surgery of Genito-Urinary Organs, Rebman, 1907, p. 426.

BONE ABSCESS TREATED WITH MOORHOF'S BONE WAX.

A REPORT OF FIVE CASES.*

BY CHANNING C. SIMMONS, M.D.,

OF BOSTON, MASS.,

Surgeon to Out-Patients, Massachusetts General Hospital; Assistant in Surgery,
Harvard Medical School.

THE following report is based on five cases of chronic osteomyelitis with bone abscess treated with the iodoform bone wax advocated by Mosetig-Moorhof.¹ Moorhof,^{2 3} Silbermark,⁴ and others have reported such good results following the use of the wax, with shortening of the convalescence, absence of painful dressings, etc., that it should, if the report of these cases were correct, be a distinct improvement on the usual method of treatment.

The author has used the wax in two other cases more recently which are not included here, which have so far done well, although it is too early to draw any conclusions as to the end result. Moorhof advocates his wax in all chronic osteomyelitis cases with bone abscess, in tubercular bone cavities, and as an injection after the excision of a joint. It serves only as a temporary plug to replace the tissue removed and later is either absorbed or extruded. It is of no use in acute or diffuse osteomyelitis, and in the chronic cases one should wait until the acute exacerbation has subsided before applying the filling.

As a rule, the use of foreign substances to fill cavities in the body, although strongly advocated by the originator of a method, has in the hands of the general surgeon given poor results and has gradually been discarded, giving way to the older method of packing and draining.

* The author wishes to express his thanks to Dr. M. H. Richardson, Dr. S. J. Mixter, and Dr. C. A. Porter for permission to operate upon and report these cases which were admitted to their wards.

Among the many substances that have been advocated may be mentioned blood-clot, decalcified bone chips, muscle flaps by transplantation, skin flaps by plastics, and Beck's bismuth paste. Blood-clot has been used by the author with perfect success in three cases of bone cyst in which there had never been suppuration and sterilization of the cavity was unnecessary, and in two cases of long-standing osteomyelitis, in which the cavity contained only clear fluid. The main disadvantage in the use of blood-clot is that it is an ideal culture medium, but, on the other hand, it is not a foreign body and is well tolerated.

This report does not deal with the use of the wax in tuberculosis or in the soft parts, but only with bone abscess. In children these almost invariably do well under the ordinary treatment, opening and drainage, but the operation necessitates for a greater or lesser period of time packing or the insertion of a wick, which is painful, and there may be a free discharge of pus. In addition, the common history is profuse discharge for a long time and frequent painful dressings.

Moorhof's first report¹ appeared in 1903. Since then the component parts of the wax have been modified by some men, and Moorhof himself substitutes dermatol for iodoform in certain cases.

The wax is usually made as follows: equal parts of spermaceti and oil of sesame are sterilized in a water bath, and later 60 parts of this is mixed with 40 parts of iodoform. This gives a yellowish, brittle wax, melting at about 50° Centigrade. When used it is heated to just above the melting point and kept constantly stirred, or the iodoform will settle to the bottom of the flask. Care must be taken also not to overheat the mixture or the iodoform will be decomposed.

Quite a number of articles have been published reporting cases treated with the wax with, on the whole, good results. Meurer,⁵ who gives a good bibliography, describes in detail 45 cases, and concludes that its use permits of a more conservative treatment of these cases and insures prompt healing. Nine of his cases were osteomyelitis, with six perfect results and three failures. Of the total number treated, 34 were

“successes” and 25 of these healed by first intention. Moorhof reports 195 cases treated with the filling, all with good results; 79 of these were osteomyelitis. The report is detailed and is accompanied by a large number of good radiographs.

Histology.—Silbermark⁶ has done a series of experiments on dogs, making bone cavities, filling them with the wax, and examining them at varying lengths of time up to three weeks. As a result of these he concludes that the cavity is slowly filled with granulation tissue, later forming fibrous tissue and new bone, the wax being absorbed; but the process takes place so slowly there is little danger of iodoform poisoning. Iodine can, however, be demonstrated in the urine for some time, and cases of iodoform poisoning have been reported (Kotzenberg).⁷ This observer gives the results of 11 cases operated upon by him. One of these cases was a cyst of the lower jaw, three were tubercular cavities (all healing by first intention), and eight osteomyelitis cases. Of these last, two healed by primary union, three went somewhat septic, and three had a sinus discharging only serum for some time. He considers that the success of the operation rests on the asepsis and that the sepsis in his cases was not the result of the wax.

The operation should be performed as follows, and the success depends on the attention to details and the care with which the various steps are carried out. Silbermark⁴ has devised many special instruments, such as a saw attached to a dental engine, a burr, and a hot-air apparatus for drying the cavity.

The operation described below presumes the cavity to be in the tibia, and should be modified as occasion and the bone involved demands. The leg should be elevated and an Es-march bandage and tourniquet applied to render it bloodless.

An incision, four or five inches long, curved to the inner or outer side, is made and carried down to the bone. The flap is then dissected back, with the opening of the sinus in the centre if one is present. A flap of periosteum is turned back, or this may be done with the skin flap, and the bone with the cloacæ in it exposed. The cortical bone is then removed

with a chisel or circular saw, and the cavity freely exposed, so that all parts are accessible. It is usually necessary to remove a large portion of the cortex to accomplish this, which may be difficult and tedious on account of the eburnation. The cavity when opened is usually filled with thick yellow pus and indolent granulation tissue. Every portion of the cavity should then be cleaned until firm, healthy bone is reached, curettes of varying shapes and sizes being used and later, if necessary, a burr. The object is to get it as clean and in as good condition as a dentist would a cavity in a tooth for filling. After removing all dead tissue, the cavity should be rendered sterile and dry in order that the wax may stick to the walls, and if this is done thoroughly, subsequent ooze is effectually stopped by the wax. Sterilization is best accomplished by swabbing out with 95 per cent. carbolic acid followed by alcohol. The cavity may then be douched with a 1 per cent. solution of formalin, adrenalin, or salt solution, to stop any ooze from the bone, a slight amount of which will occur in spite of the tourniquet. Drying was best accomplished in the cases reported by treating the walls of the cavity on the principle that one would use to dehydrate a microscopic specimen. It was first washed out with alcohol, then alcohol and ether, and lastly with ether. This was followed by a hot air blast, which, in the author's hands, has not been very satisfactory. The hot air apparatus used consisted of a foot pump which forced air through a coil of $\frac{3}{8}$ in. copper tubing, which was kept red hot over a Bunsen flame. The air was filtered through cotton to remove the dust and was presumed to be sterile. To the ends of the copper tubing a piece of sterile rubber tubing having a glass nozzle was attached. This drying process is by far the most difficult step in the operation and is quite important. Once dry, the cavity is filled with the wax, which is kept constantly agitated in the flask to prevent the settling of the iodoform, the laws of gravity being observed in the process. It is usually more satisfactory to let the leg hang down while the lower portion is being filled, and as soon as the wax is partially set, to tilt it up and

fill the upper portion. The flap is then drawn over and the periosteum and skin sutured, a small gutta-percha wick being left in from 24 to 48 hours if necessary. The line of the skin incision should not be directly over the cavity in the bone. Before suturing the flap in place, all sinuses and granulating areas should be either excised or sterilized with carbolic acid and alcohol. A firm dressing is applied and the tourniquet taken off, what little bleeding there is being controlled by pressure. Dressings should be done at intervals of two or three days.

Healing in the ideal cases and in many of those reported has been by first intention, but primary union was not obtained in any of the cases herein reported. The later history has been in all a sinus that has discharged a small amount of clear serum and filling, not pus, for a varying length of time up to four months.

ABSTRACT OF CASES.

CASE I (Dec. 16, 1908).—Male, aged thirty-three. Twenty years ago kicked below the knee by a horse. The place became red, swollen, and tender, and in two months broke open, discharging pus for three months. Four years later without cause it broke again, discharging for two months. For past 15 years has caused no symptoms. Denies venereal disease.

One year ago leg again began to pain and was opened by a physician. It healed in a few weeks. One month ago the same thing happened. The incision is now healed, but the leg is painful and tender.

Physical examination unimportant, except as regards leg. Over the head of the left tibia is a red, tender, semifluctuant swelling, three inches in diameter. The bone is considerably thickened and the skin shows scars of the previous operations. Radiograph shows an indefinite cavity in the head of the tibia, surrounded by thickened cortical bone, and considerable periostitis.

December 18: Operation. Incision over head of tibia and considerable serum evacuated; no pus. Culture showed pure staphylococcus.

December 22: Esmarch bandage, tourniquet. Incision over

head of tibia carried down to bone. Periosteum thickened. Flap dissected free, and cortex removed with chisel, opening a cavity 1 x 2 inches in diameter filled with pus. Cavity cleaned with curette, gauze, etc., till all infected parts removed. Sterilized with carbolic acid, alcohol, and adrenalin (for ooze). Dried with alcohol and ether and hot air blast. Filled with wax and wound closed tight. This was done with difficulty, as the soft parts were so swollen they came together with considerable tension. Culture showed *Staphylococcus aureus*.

Subsequent History.—Convalescence was uneventful. There was considerable ooze from between the stitches, the serum containing flakes of iodoform. Eventually the wound healed by first intention, except a small sinus, which continued to discharge serum and filling for about four months. At no time was there any pus, and the patient learned to dress his leg himself with gauze. From the time the wound healed till the present date, 15 months from the time of operation, there has been no trouble.

X-rays were taken before (Fig. 1) and immediately (Fig. 2) and three months after operation, and also one year after operation (Fig. 3). They show the gradual diminution in size of the cavity and the final replacement of the wax by normal bone. The halo around the filling in Fig. 2 is the granulation tissue in the cavity which has not yet become bony.

CASE II (March 10, 1909).—Male, aged fourteen years. When four years of age sores broke out on his legs, and since then has had discharging sores on the leg about once a year. Has also had sores break out over the left scapula, on the left wrist, and over the ribs on the right side at various times. Three months before entrance sore broke on right leg and has not healed.

Examination.—Scars of old wounds over left scapula, to outer side of left thigh, over the seventh rib on the right, on the inner side of right thigh just above knee, and two others over the head of the right tibia. Over lower third of right tibia, soft parts swollen, red, tender, and fluctuant. Radiograph shows a bone abscess about 4 in. above the ankle in the tibia on the right (Fig. 4).

March 13: Incision and considerable pus evacuated.

March 26: Esmarch bandage, tourniquet. Old incision and sinus excised. Considerable bare cortical bone found. Cortex removed and cavity opened. Cured, sterilized with carbolic

FIG. 1.



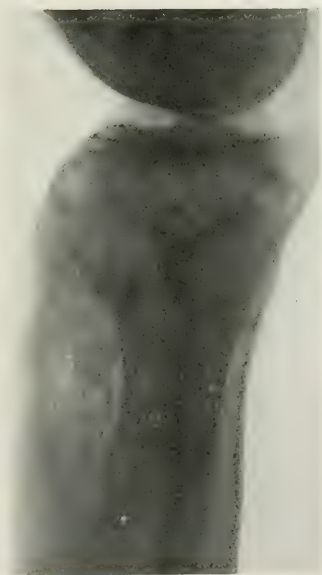
Case I before operation. Abscess head of tibia. Some periosteal and marked cortical thickening which obscures the cavity in the radiograph.

FIG. 2.



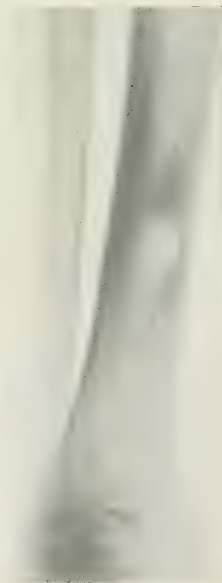
Case I a few weeks after operation, showing the cavity filled with wax.

FIG. 3.



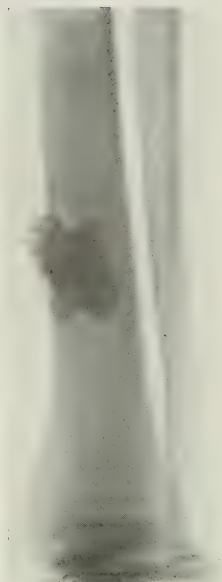
Case I one year after operation. Wax discharged or absorbed and cavity filled with normal cancellated bone.

FIG. 4.



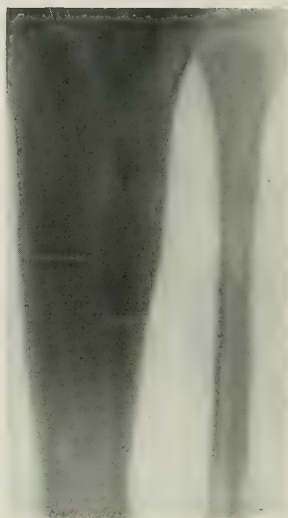
Case II before operation. Abscess cavity shows plainly in the shaft of the tibia. There is some periostitis.

FIG. 5.



Case II after operation. The cavity filled with wax.

FIG. 6.



Case III before operation. Marked cortical and periosteal thickening. Abscess cavity seen indistinctly.

FIG. 7.



Case III some weeks after operation. The light area around the wax is granulation tissue which is replacing the filling.

acid and alcohol, dried with ether, and filled with wax. Skin flap and periosteum sutured in place with some difficulty, because of tension. Culture showed *Staphylococcus aureus*.

Recovery uneventful. Wound healed by first intention with a small sinus, which discharged serum and flakes of wax (Fig. 5). Discharged from hospital April 12, 1909.

May 5, 1910, thirteen months later, reports by letter that the leg is "all right," but the wound discharged some during the winter. The letter was very unsatisfactory, and the questions asked not answered.

CASE III (May 6, 1909).—Male, twelve years of age.

Nine months ago went to bed with "rheumatism" in the right knee, which persisted for five months. Four months ago hit his right knee, the trauma being followed by pain and swelling, and an abscess formed and broke. This has been discharging ever since.

Examination.—Opening of discharging sinus 2 in. below right knee, through which dead bone may be felt. Head of tibia thickened. Radiograph shows the knee-joint sound, considerable thickening of the cortex, with periostitis and a distinct cavity in the head of the tibia (Fig. 6).

Operation (May 13).—Esmarch bandage, tourniquet. Incisions over head of tibia and sinus excised. Periosteum dissected back and cortex removed with chisel, opening a cavity $2 \times 1\frac{1}{2}$ in. in diameter filled with thick pus. Cured clean and sterilized with carbolic acid and alcohol. Dried with alcohol, ether, and hot air. Filled with wax, and skin and periosteum sutured over, there being too great tension to allow complete closure.

Culture showed *Staphylococcus aureus*.

Following the operation there were several pockets of pus in the soft parts about the knee, but the bone cavity did well.

Discharged from hospital July 3, 1909, with a small sinus discharging serum and filling (Fig. 7).

November 17: Good use of leg. Sinus closed for some time.

April 30, 1910: Wound solid. No pain. Function of knee perfect.

CASE IV (May 12, 1909).—Male, nine years of age. Three weeks ago sprained left ankle. Since then it has been swollen, red, and tender, and he has not been able to use the leg.

Examination.—Over left internal malleolus is a tender, red

swelling, evidently connected with the bone, hard, and non-fluctuating. Foot swollen. Radiograph shows an irregular cavity in the lower end of the diaphysis and a possible smaller one in the epiphysis. There is considerable periostitis.

Operation (May 19, 1909).—Esmarch bandage, tourniquet. Three-inch incisions over lower end of tibia carried to bone, and periosteum dissected back. Cortex removed with chisel, and a cavity one inch in diameter filled with thick yellow pus opened. Cleaned out, sterilized, and dried as in previous cases. Filled with wax, and periosteum sutured. Wound closed without drainage. Culture sterile.

Wound apparently healed by first intention, but three weeks after operation a sinus opened which discharged a small amount of serum and filling for about three months.

May 2, 1910: Wound solid. No interference with motion. Perfect result. X-ray taken.

CASE V (May 12, 1909).—Male, twenty-six years of age.

Nine years ago left knee became swollen and tender without known cause, and broke open, discharging pus. He was in bed nine months at this time. Since then the sore has broken open once or twice a year, discharging each time for a few weeks.

Present Attack.—Nine weeks ago the leg became painful and tender, and has confined him to bed until the present time.

Examination.—Over anterior inner aspect of left tibia a short distance above the ankle is a dull red, tender, fluctuant swelling, several inches in diameter. Radiograph shows considerable periostitis and a cavity in the bone at this point.

Operation (May 24).—Esmarch bandage, tourniquet. Incision to bone. Periosteum elevated and cortex removed with chisel, opening a cavity 1 x 2 in. in diameter filled with pus; cleaned, sterilized, and dried as in previous cases. Filled with wax, and soft parts approximated with difficulty, leaving a considerable defect in which a small wick was inserted. Culture showed *Staphylococcus aureus*.

Recovery uneventful. The sutured portion of the wound healed by first intention, and at discharge there was a small sinus discharging serum and some of the filling.

May 31, 1910: Examination shows wound solid. No pain or discomfort since operation. Motions of ankle perfect. Sinus continued to discharge before healing for about six months.

REMARKS.—An analysis of these cases shows the following results:

None healed absolutely by first intention.

The bone cavity in all of the cases was evidently rendered sterile by the cleaning process, and the wound in three, the only ones closed without drainage, healed by primary union, with the formation later of a sinus discharging serum and wax. Culture from four of these cases showed *Staphylococcus aureus*, while the other was sterile.

Case III was operated upon while there was considerable inflammation, and it would have been better to have waited until this had quieted down. Although following operation there was pocketing of pus in the soft parts, the cavity in the bone gave no trouble, the wax apparently keeping the pus out. On leaving the hospital the discharge from the sinus was of serum and filling, as in the other cases, and the end result has been good.

In Case V there was no attempt to get primary union as the tension of the soft parts was too great, but at discharge the leg was in the same condition as the other cases.

The wax in all the cases made a remarkably good dressing, obviating the necessity of changing wicks, and making the dressing easy and painless.

As to the end results, Cases I, III, and IV and V may be called perfect at the end of one year. There is no interference with the function of the limb, the wound is solid, and in Cases I and V, X-ray shows the cavity evidently filled with normal bone. There is no trace of the wax, which has been either absorbed or discharged.

What the result would have been if the abscesses had been treated in the usual way, by opening and packing, cannot be said, but it seems improbable that they would have done as well.

Case II may now be considered well, although the progress of the case was not as satisfactory, judging from the letter received, as in the others.

More or less difficulty was experienced in all of the cases

in closing the wounds, due to tension, which could have been obviated to some extent if the incisions had been made more curved and the flap, therefore, larger, although in no case was the opening into the bone made directly under that through the skin.

CONCLUSIONS.

Moorhof's iodoform plombe or bone wax is of value as a filling, in selected cases of circumscribed abscess cavities in bone.

Its use shortens the convalescence and makes the dressings easy and painless.

The success of the operation depends on painstaking care and attention to detail.

In the above cases, at least, the wax was treated by the body as a foreign substance and discharged.

BIBLIOGRAPHY.

- ¹ Moorhof: Wein. kl. Woch., 1903.
- ² Moorhof: Deut. Zeit. für Chir., No. 71, p. 419, 1904.
- ³ Moorhof and Jones: Lancet, vol. i, p. 146, 1905.
- ⁴ Silbermark: Deut. Zeit. für Chir., vol. lxvi, p. 589, 1904.
- ⁵ Meurers: Beit. z. kl. Chir., vol. lvi, p. 215, 1907.
- ⁶ Silbermark: Deut. Zeit. für Chir., No. 75, p. 290, 1904.
- ⁷ Kotzenberg: Arch. f. kl. Chir., No. 81, p. 977, 1907.
- Moorhof: Surg., Gyn. and Obst., vol. iii, p. 547, 1906.
- Walton: Lancet, vol. i, p. 155, 1908.
- Moore: Jour. Am. Med. Assoc., vol. xlv, p. 1582, 1905.

LACERATION OF THE AXILLARY PORTION OF THE CAPSULE OF THE SHOULDER-JOINT AS A FACTOR IN THE ETIOLOGY OF TRAUMATIC COMBINED PARALYSIS OF THE UPPER EXTREMITY.*

BY T. TURNER THOMAS, M.D.,
OF PHILADELPHIA.

WE are all more or less familiar with those cases in which the upper extremity becomes partially powerless, the muscles, especially those about the shoulder, atrophied, and the shoulder and arm stiff and painful, from a trauma of the shoulder region. Among the neurologists, in particular, the tendency has been to ascribe them to a lesion of the brachial plexus, as in Erb's palsy, in which the trauma is localized to a point above the clavicle, where the nerve-fibres to the muscles usually found involved are grouped together (Erb's point). In the cases which I have in mind, scapulohumeral limitation of movement is associated, on account of which, I believe, many of them have been ascribed by surgeons, in particular, to inflammation in the subacromial or subdeltoid bursa. I have stated in detail elsewhere¹ that I do not believe they are best explained by the bursitis theory, which does not account for the loss of power, and the supporters of which admit that they have difficulty in explaining the pain frequently radiating down the arm. Codman² says that in some cases these secondary changes in the nerves and muscles almost amount to a real paralysis and simulate lesions of the brachial plexus or progressive muscular atrophy. Nerves may be ruptured but I believe that in most cases they are not. The basic lesion, in my opinion, is a more or less extensive laceration of the axillary portion of the capsule of the shoulder-joint, the lesion of an anterior dislocation of the shoulder.¹ The essential cause of the dislocation is forced abduction of the arm, the most free and least restricted move-

* Read before the Philadelphia Academy of Surgery, October 3, 1910.

ment in this joint, and the movement most frequently exposed to severe violence and to the leverage of a fully extended and rigid upper extremity, as in falls on the hand. The chief resistance at the shoulder to movement beyond the physiological limit due to forced abduction is from the axillary portion of the capsule, which frequently tears in consequence. Often from such a force an anterior dislocation of the shoulder results, in many of which, as the arm immediately afterwards drops to the side of the body, spontaneous reduction takes place and the fact of the occurrence of the dislocation is never recognized. In probably a great many more, the tear in the capsule is not sufficient to permit a dislocation, and it then represents the lesion of a sprain, a condition which at the present time is practically never recognized as such. The lesion is deep seated and difficult to locate by the ordinary signs of a sprain. The patient does not recall that forced abduction was a factor in the causation of the symptoms, because of the excitement of the moment, and because immediately afterward the arm fell to the side of the body into the position of rest, of most complete relaxation of the torn portion of capsule and therefore of least pain, where he finds it when he begins to take account of what has happened.

Internal rotation further relaxes the injured portion of capsule, so that the patient soon learns to keep the forearm in front of the chest in the sling position. Abduction and external rotation, especially the former, drag upon the seat of trouble and are avoided so long, that when the pain subsides and the patient wishes to use the limb, he finds that he cannot move it far from the side, the torn portion of capsule having become contracted in its relaxed condition. The loss of power and the atrophy of the muscles of the shoulder and arm are due primarily, I believe, to the involvement of the nerves in the axilla by perineuritis and neuritis from the inflammatory conditions in the axilla, which are secondary to the lesions in and about the joint. The atrophy and loss of power are probably in part due to the resulting scapulohumeral limitation of movement, and I have thought that it was in part due to the limitation of movement per se, *i.e.*, that there resulted a certain loss of balance in the functions of the muscles of the extremity

because some of those at the shoulder were thrown out of action by the shortened capsule. This was suggested by an observation in one case, in which a considerable impairment of the movements of the hand disappeared on the day on which the scapulohumeral limitation of movement was broken under an anæsthetic and the arm dressed in full abduction. The patient was delighted to find that so quickly all of the movements and much of the power had returned to this hand. Nothing else had been done than to tear the shortened capsule that could explain the return of power in the hand, so that I could see no other explanation than that the scapulohumeral ankylosis alone had been in some way responsible for the weakened movements in the hand and perhaps for some of that in the forearm and arm.

I am not prepared to enter into a detailed discussion of an intricate and confused neurological question, but I have been impressed with an apparent similarity between these stiff and painful shoulders and some of those which are called, by the neurologists in particular, traumatic brachial paralyses; and I wish to offer a few facts which tend to show why they are often confused with each other. The surgeon is usually impressed most by the disturbances in the shoulder-joint, the neurologist by the loss of power in the muscles. The latter rarely takes into account the scapulohumeral ankylosis, occasionally referring to it vaguely as secondary to the condition of the nerves and muscles, that is, to contractures of muscles and ligaments.

Schulz³ made an interesting study of the late results in cases of dislocation of the shoulder which appeared in Küttner's clinic at Breslau during a period of five years. There were 160 cases, but a large number failed to return for re-examination, and some of the remainder were excluded because of the complications which existed. The late results in 54 uncomplicated (by any fracture, according to the X-ray, by myositis ossificans, or nerve paralysis) traumatic dislocations did not justify the prevailing tendency to give a favorable prognosis after reduction of a dislocation of the shoulder. In only seven cases (13 per cent.) were there no disturbances of motion in the arm, no noteworthy diminution of strength,

and no pain in bad weather. In 14 cases (26 per cent.) the movement was free, but the power in the arm was reduced at least a third, in most a half, and in one two-thirds. In 39 cases (75 per cent.) there was weakness in the arm, and in about a half of these there was more or less continual pain in the shoulder, which was so much worse in bad weather that it became necessary to suspend work. In many cases movements absolutely necessary for many occupations could not be performed at all or only to a slight extent. Schulz says that the chief cause of these poor results is to be sought in the cicatricial contraction of the joint capsule and surrounding tissues.

Delbet ⁴ and Cauchoix in a recent study account for what seems to me to be very much the same type of disturbances following dislocations of the shoulder, by assuming the existence of injuries to the nerves. They say that at first it was universally admitted that these nerve lesions were due to the wounding of the terminal trunks of the brachial plexus by the luxated humeral head, but that at the present time this conception is much combated, because the muscle groups paralyzed correspond not to the territory of innervation of a nerve but to that of a root. They consider it unnecessary to dispute all the theories which have been offered to explain how these paralyzes are produced. It appears to me that we have, in these various theories referred to, an indication of the obscurity of the etiology of the loss of power frequently associated with dislocations of the shoulder. Delbet and Cauchoix consider that most authorities at the present time accept the theory of a radicular paralysis in most of the cases due to a trauma about the shoulder; and they divide the cases into those due to lesions of the roots of the plexus or radicular paralyzes, those due to lesions of the plexus itself, and those due to lesions of the terminal branches of the plexus. The chief object of their work was to encourage early operation. In three cases they exposed the nerves in the axilla and freed them of adhesions. When the plexus or its roots are the seat of the lesion they advise a similar operation above the clavicle. Vandebossche, ⁵ in discussing traumatic radicular paralyzes due to injuries about the shoulder, says that because of the multiplicity of the

nerve lesions, their association with truncular lesions, and the fugaciousness of certain symptoms, the diagnosis of these paralyses is difficult to make, except at the beginning. He also favors operation in grave cases.

That the radicular and plexus lesions are considered as frequently being due to injuries of the shoulders other than dislocations is attested by the already extensive literature on the subject. Underlying all this discussion and confusion, and in my opinion accounting for it, is the difficulty in locating a nerve lesion, which can explain the great variety of the nerve manifestations presenting themselves in these cases. Originally, as stated by Delbet and Cauchoix, the tendency was to locate the lesion in the axilla, that is, that it was due to the trauma produced by the dislocated humeral head. This became untenable, because the distribution of the nervous disturbances was too extensive and varied to be accounted for by such isolated nerve lesions as could be expected from such a cause. In the search for a higher nerve lesion, the condition of the joint is generally ignored. I suspect that scapulo-humeral limitation of movement is nearly always present in these cases diagnosed as traumatic brachial paralyses, and if the various nerve symptoms which occur could be accounted for on the basis of the conditions existing in the axilla, a long step would be taken in the direction of clearing up the pathology. I have already shown that a sprain of the shoulder is probably common to those cases due to a wide variety of accidents to the shoulder region, and I have pointed out that the pathology of a sprain due to forced abduction at the shoulder is essentially the same as that of a dislocation of this joint.¹ The tear in the axillary portion of the capsule occurs in all, but is most extensive in the dislocation which may be regarded as the type. Hemorrhage must occur in every case and will vary with the number and size of the blood-vessels opened. Some of the large lymph trunks which are numerous here may also be torn. The extensive opening into the joint is in the most dependent portion, so that the extravasated synovial fluid, blood, and lymph fall by gravity into the loose tissue of the axilla, which has been more or less displaced and lacer-

ated in luxations by the head of the humerus. Ewald⁶ believes that traumatic myositis ossificans always occurs in muscles about joints, and is due to the effect of the escaping synovial fluid which infiltrates itself among the muscle-fibres. If this were true, the synovial fluid is capable of inducing a high degree of irritation. The presence of the blood, lymph, and synovial fluid in the axilla, where they surround and infiltrate the various branches of the brachial plexus, and the inflammatory reaction induced by their presence and the associated trauma can account for a marked degree of perineuritis and neuritis in some or all of the nerves in the axilla. According to the number of nerves thus involved and the degree of involvement, we may have a large variety of nervous manifestations, and we need not assume the existence of a direct trauma to the terminal branches of the brachial plexus, the plexus itself, or its roots to account for them. The evidence which I have examined, to my mind, does not seem to indicate that actual nerve rupture in dislocations is especially common. The most frequently ruptured nerve is evidently the circumflex, but I believe that in many of the cases in which the diagnosis is made of a paralysis of the deltoid from a rupture of the circumflex nerve, the nerve is not so much injured as inflamed or bound in cicatricial tissue. I believe also that the marked atrophy of the deltoid seen in these cases is the result, not so often of a complete or a partial rupture of this nerve as of the compression of the nerve by the extravasation and the associated neuritis and perineuritis, of the consequent adhesion, and of the scapulohumeral limitation of movement, which throws the deltoid out of action more than any other muscle because it is the great abductor of the arm.

Delbet and Cauchoux collected from the literature 33 cases in which symptoms of paralysis of the muscles of the upper extremity followed dislocations of the shoulder, and added two of their own, with another case in which the paralytic condition followed a fracture of the surgical neck of the humerus. The evidence obtained from them, as these writers interpret it, pointed to traumatic lesions of the nerves; and in so far as it was demonstrated by operation and postmortem, it showed

involvement of the nerves in the axilla in most cases. In my opinion, these cases can be best explained by the changes produced in the nerves by the inflammatory reaction induced by the extravasated blood, lymph, and synovial fluid, and the trauma of the neighboring tissues.

The autopsy in the case of Th. Anger, performed seven days after the accident, revealed a bloody extravasation of the circumflex nerve to an extent of 2 cm., at the site of the capsular tear and extending into the terminal branches of this nerve. (The circumflex nerve passes backward between the subscapularis and latissimus dorsi muscles, and for a short distance lies directly on the capsule in the immediate vicinity of the tear, so that it is particularly exposed to the exciting causes of inflammation already referred to.) Bardenheuer in operations found intraneurilemmatic effusions, which he thought were produced at the time of the rupture of the surrounding blood- and lymph-vessels. The condition of the nerves was distinctly inflammatory, and he considered it sufficient to cause the conductivity of the nerves to disappear by the compression which the inflammation exercised on the nerves. Nicaise found the circumflex nerve swollen, between the inferior borders of the subscapularis and teres minor muscles (the nerve here lies directly on the capsule), and the nerve was enclosed in a sheath of inflamed cellular tissue. The histological examination showed an intense perineuritis. In another case Nicaise found the circumflex nerve bound in dense cellular tissue, in front of the capsule. Panas found a roughening of the circumflex nerve. Vincent determined clinically a paralysis of the median and ulnar nerves, and the case coming to autopsy, he discovered these two nerves surrounded by a zone of thickened fibrous tissue separating the luxated humeral head from the second rib. Müller found a complete disappearance of the axillary fat, which was replaced by resisting connective tissue. It was difficult to follow the nerves toward the summit of the axilla on account of their adhesions. In Wallis's case the terminal trunks of the brachial plexus were adherent to the periosteum of the humerus just below the surgical neck. Delbet and Cauchoux met with similar conditions in their own three cases.

There is little in these findings to show an actual rupture of the involved nerves, but much to indicate that they had been enveloped in a zone of inflammation due to the lesions in the surrounding structures produced by the dislocations. I believe we may fairly assume that the nerve lesions in those cases of paralysis from trauma about the shoulder, without dislocation, are of a similar character. That actual nerve rupture is not the rule in these cases, as I have seen them, is suggested by the fact that these paralyzes tend toward recovery. Either with the assistance of the physician or without it, persistent efforts are usually made to increase the movement in the joint, and this tends to lengthen the contracted tissues, to favor absorption of the inflammatory tissue, and to loosen adhesions, all of which favor a return of the nerves and muscles toward the normal. Many of them, however, fall far short of reaching the normal. Prolonged rest favors a more dense and persistent contraction of the tissues and a more permanent atrophy of the muscles and loss of power. There is a variety of these cases, in which the humeral head falls appreciably below the acromion process, leaving a distinct depression between the two. The joint becomes flail-like, the arm practically helpless, and to a less extent the forearm and hand. This condition is very serious, I believe permanent and sometimes progressive, although my experience with it has not been extensive enough to warrant a positive expression of opinion. I have purposely avoided discussing it here because it deserves more attention than I can give it now.

The following is the only case in which I have had the opportunity of observing the patient from the day of the accident. It presents a few features which are particularly interesting and instructive.

A colored man, fifty-six years old, on June 26, 1910, was found unconscious in the subway, where he was employed as a laborer, and in an unconscious and delirious condition he was brought to the University Hospital, where he was admitted to the service of Professor J. William White, to whom I am indebted for the privilege of reporting the case. Examination showed a cut over the right eye, a contusion on the back of the head, and subcon-

junctival ecchymosis of the right eye. The pupils were equal and reacted to light, and there was no bleeding from the nose or ears. On the following day on account of his delirium and outcries he was placed in a side room, and because of the violence with which he threw himself about, he was strapped down by the wrists and ankles. In going over the matter later with the interne and the attending nurse, both were positive as to the violence with which he threw about his two arms, and both were satisfied that there could have been no loss of power in them at that time. My own recollection of the patient's actions during my visits, and the fact that he had been strapped down by the wrists confirmed these statements. On the third day the unconsciousness had cleared slightly, and it was observed that he could not raise his left arm or forearm from the bed and that he had very little power in that hand. On the following day there was slight improvement in power in the hand and forearm, but he could not move his arm. On passive abduction at the shoulder after the arm passed a right angle, the patient, who was conscious enough by this time to appreciate it, complained of pain in the axilla and resisted the movement. There was also marked tenderness on pressure in the axilla. On full abduction there was observed a considerable but well-outlined swelling about on a level with the shoulder-joint. It suggested a hæmatoma. Although the mental condition improved very much, there was little change in the condition of the left upper extremity. On July 2, a neurological examination was made by Dr. J. W. McConnell, and the following facts noted: No disturbance of the pupils or of the sphincters. Patient complains of a sensation as if the left hand, forearm, and arm were asleep. The muscles of the whole extremity are extremely weak. Those of the right can be well performed except abduction, which when performed actively or passively, seems to cause considerable pain referred to the shoulder-joint. The same condition obtains on the left side with, additionally, when the abduction is almost completed, a distinct swelling which appears just behind the pectoral border. This swelling is soft and not to be found on the right side under similar circumstances.

Individual movements can be made as follows: Extension, flexion, and abduction of the fingers of the left hand performed, but much less well than on the right side. Extension and flexion of the hand at the wrist-joint are less well performed than on

the right, but better than the movements of the fingers. Pronation on the left side better performed than supination, but both movements better than on the right side. Flexion of the forearm gives distinct contraction of the biceps. Distinct contraction of the supinator longus but much less power than would be expected from such a contraction. Same is true of extension on this, the left side. Voluntary abduction of arm very slight. Attempt at adduction causes distinct movement of adductor muscles but very little movement of arm. Passive rotation of arm on its long axis is fairly well performed, and the excursion is quite as large as in the right arm. Electrical examination shows prompt galvanic response in normal series. There is an area of hypalgesia in left hand, including an area on the ulnar side of the dorsum of the hand up to the styloid process of the ulna and extending over to and including the third metacarpal (middle finger); also over the dorsal surface of the little finger and dorso-ulnar surface of the palm to the median line and fissure in palm, indicating the metacarpophalangeal articulations. Reflexes normal.

I had not observed any trouble with the right shoulder and arm until Dr. McConnell discovered it, nor did I know that the left was involved until the interne, Dr. Sprowl, called my attention to the weakness in the hand and forearm. I concluded that I was dealing with a bilateral tear of the axillary portion of the shoulder capsule. I endeavored to prevent contraction of the capsule by forcing once daily each arm into full abduction. Against the complaints of the patient I persisted in this effort for about two weeks, but the resistance and pain gradually increased and I concluded to give it up. The right shoulder now gave him most trouble, and the resistance was more marked than on the left side. Hoping to prevent further contraction of the capsule on this side, I fixed the shoulder by a plaster cast, with the arm at slightly less than a right angle. The cast was removed nine days later. The scapulohumeral limitation of movement and loss of power in the arm were more marked than on the left side, on which the loss of power below in the hand and forearm was much more evident.

August 1: The patient had been receiving for several days in the orthopædic gymnasium massage and passive movements, but he now insisted on going home, which he was permitted to do. Although he promised to return for further treatment, he failed to do so.

That the paralysis in this case was not due, primarily, to a traumatic lesion of the brachial plexus, is shown by the fact that for about 48 hours the arms were moving about vigorously, and straps at the wrists were required to restrain them. The first evidence of loss of power was detected on the third day in the left extremity, that in the right arm not until about a week had passed. That the lesions which caused all the trouble were in the axillæ of both sides was clearly evident from the severe pain there on abduction of the arms and the associated scapulo-humeral limitation of movement. The localized swelling in the left axilla suggesting a hæmatoma gradually disappeared and was no longer evident when the patient left the hospital. It indicated strongly that its location directly under the shoulder-joint was due to a tear of the axillary portion of the capsule and consisted of a collection of blood from torn vessels, possibly also of lymph and synovial fluid. The pressure of the extravasated material and inflammation about the nerves will account for the gradual development of the nerve symptoms, which appeared earlier on the side on which the extravasation was most marked. The whole clinical picture, to my mind, is one that can be accounted for only by an extensive tear of the axillary portion of the capsule on each side.

In connection with this case I would again call attention to Schulz's observations. Of the 160 dislocations of the shoulder, he studied only the 54 uncomplicated cases, *i.e.*, uncomplicated at the time of the dislocation and the reduction by any nerve paralysis. Therefore, the evidence of involvement of the nerves which developed later can be accounted for only by assuming that it was the result of, and secondary to, the joint condition, as in my case. Schulz so concluded.

Another similar condition, the pathology of which has never been satisfactorily explained, is the infantile obstetrical paralysis, or brachial birth palsy. Duchenne⁷ was one of the first to call attention to it. Unfortunately I have not been able to gain access to his contribution on this subject and the following is a translation of his conclusions by H. M. Thomas:⁸ "Certain violent obstetrical measures, which may be necessary during the difficult lowering of the arm after

the body of the infant has been born, or the strong traction on the shoulder by a finger introduced in the shape of a hook in the axilla, after the head has been born, may at times produce a paralysis of the arm, localized in the deltoid, infraspinatus, and flexors of the forearm, and characterized by the falling of the arm close to the side of the body, the rotation of the arm inwards, and extension of the forearm on the arm. The prognosis of this paralysis is, in general, grave; it may be cured by local faradization, but if this is abandoned, it becomes incurable and produces atrophy of the member." Erb calls attention to the similarity between these cases and those in which the brachial plexus is injured in adults, and believes that they are due to pressure at Erb's point, situated 2 to 3 cm. above the clavicle and somewhat outwards from the posterior border of the sternocleidomastoid and just in front of the transverse process of the sixth cervical vertebra. Stimulation at this point produces a simultaneous contraction of the deltoid, biceps, brachialis anticus, and supinator longus (apparently usually also of the infraspinatus and subscapularis). Thomas says that, why such varying conditions as are known to produce the paralysis should always make pressure at this point, was not explained. Carter was the first to advance the theory that in the great majority of cases stretching of the upper roots of the brachial plexus, and not pressure on the plexus, was the cause of the paralysis. The latter view seems to be the generally accepted one at the present time. Schoemaker^b collected 95 cases from the literature, and of these, 55 were head presentations and 40 breech. Without going into such a general discussion as the question deserves, I wish merely to call attention to a few facts, which will, I believe, justify the suggestion that a tear in the axillary portion of the capsule of the shoulder-joint may be the explanation of the condition found in many of these cases. Pressure at Erb's point has never been established as the cause. Stretching of the upper roots of the brachial plexus, with laceration, ought to produce more frequently a more complete and permanent paralysis than is exhibited in these cases. There is a difference of opinion as to the permanency of the paralysis, but most authorities

consider that the majority of cases tend to recover more or less completely. The most positive evidence that I have found in favor of stretching of the roots of the plexus is that offered by Clark, Taylor, and Prout.¹⁰ It would seem, at first thought, that their evidence could not be controverted, yet it does not seem that operation for these cases is being generally adopted. Apparently the prime object of their work was to show that many or most of these cases could be cured only by operation. In seven cases seen within a period of two years, they excised portions of the involved roots and sutured the ends together. In one case the rupture involved the entire plexus. Five of the remaining six showed the maximum damage above the junction of the fifth and sixth cervical roots, and one below it. In one, the fifth root was found torn across, and the ends separated about 1 cm. and bound down by connective tissue. In one case the fifth root was torn across just below the junction, and the distal end displaced inward and downward about 2.5 cm. to the front of the scalenus anticus, where it was adherent. They do not refer to any cases not operated on, and one is in doubt as to whether they operated on all their cases. If they did, then they evidently regard the prognosis as more unfavorable than most authorities. In the discussion which followed the reading of Walton's paper,¹¹ before the American Neurological Association, it was developed that no neurologist present, except Lezynsky, had ever seen an obstetrical birth palsy in an adult. Lezynsky saw one at twenty years and another at seventeen years, in one of which there had been a dislocation at birth. He saw another case in a child in which there had also been a dislocation at birth. According to the conception of the pathology entertained by Clark, Taylor, and Prout, the usual result of traction is to produce a tear in the perineural sheath, with a resulting small hemorrhage into and beneath the sheath and infiltrating the strands of nerve-fibres and the meshes of the epineurium. In all their operative cases they found the deep cervical fascia invariably thickened, especially over the plexus. An extravasation of blood, lymph, and synovial fluid, 4 or 5 inches upward under the clavicle, from an injured shoulder-joint, with the infant in the recum-

bent position, would more satisfactorily explain the thickening of the cervical fascia and the cicatricial tissue about the nerve-roots, than would a small tear in the perineural sheath or a rupture of one or two nerve-roots. If the continuity of a nerve-root was broken by traction, the divided ends would probably fall together again as soon as the traction was removed, when we would have a more perfect approximation than could be obtained by the most perfect suturing after the excision of a portion of the root. The cicatricial band of union between the ruptured ends might be difficult to locate and recognize months or years later, in an adherent mass of tissue. The question might fairly be raised as to how a separation of 2.5 cm. between the ends of the divided root is to be explained. In amputations we retrench the nerve-ends, because they do not tend to retract, and if not so treated are likely to become caught in the surrounding scar tissue. There is not enough movement of the surrounding structures to account for so much separation, and the contraction of the cicatricial tissue between the nerve-ends should draw them together. I should regard the theory that traction on the upper roots of the brachial plexus as the cause of these birth palsies is not yet established.

In a head presentation, when the head is born the next step is to deliver one arm, which then occupies a position of abduction. If the scapula did not move with the arm, this would be nearly the normal limit of abduction. Abduction beyond a right angle is permitted by movement of the scapula, which is produced by tension on the corresponding muscles, and particularly on the axillary portion of the capsule. Traction on this arm to aid the delivery of the rest of the body must apply a dangerous force to the tense axillary portion of the delicate, infantile capsule. H. M. Thomas reports three cases.

The first was seen six weeks after birth. It was a head presentation and forceps delivery. The right arm was born first and traction was made on it. Paralysis of this arm was noticed soon after birth. In the second case, seen eight days after birth, the labor was normal up to the delivery of the head. The delivery of the shoulders was difficult. The anterior (left) shoulder was engaged under the symphysis and was delivered only after considerable difficulty. The head was depressed until this

shoulder slipped under the symphysis and was delivered, when by elevating the head (thus forcing the left arm into extreme abduction), the other shoulder was delivered without much trouble. The left arm was paralyzed. It was observed of this case that the shoulder could not be abducted nor the arm rotated outward. In the third case, after a difficult forceps delivery of the head, the shoulders became fixed, and traction was made on the head flexed toward the right shoulder (evidently to deliver the left arm, which must have been forced further into abduction in the delivery of the opposite arm). It was the left arm that was paralyzed. In none of the three were the reactions of degeneration found.

I have referred to these cases because they present some evidence to show that forced abduction was employed in just the arm which was afterward found paralyzed. The most characteristic feature in cases due to a tear of the axillary portion of the shoulder-joint capsule is the scapulohumeral ankylosis, although, as already shown, it can easily be overlooked. If it were present in all birth palsies it would point very strongly to a capsule lesion as the cause of this condition. It cannot be accounted for on the basis of a rupture of the roots of the plexus. It was clearly present in Thomas's second case, it might have been in the others. Schoemaker reported two cases of his own. In one the affected arm was in marked internal rotation, and when it was raised and let go, it fell back. It is not stated that there was or was not resistance to abduction. In his second case, there was marked scapulohumeral ankylosis, almost complete. Duchenne called attention to the internal rotation of the arm, and it was present in all three of Thomas's cases. It is explained on the basis of the paralysis of the external rotators of the humerus. The theory of a torn axillary portion of the capsule will explain it. Abduction and external rotation drag upon the lacerated capsule and thus produce pain in the early stages. Therefore, the arm is held in the position of rest, adduction, and internal rotation. Later from cicatricial contraction the ankylosis tends to become permanent. The results of treatment in Thomas's cases are suggestive of a capsule rather than a nerve lesion. He employed passive motion, massage, and the galvanic current. The first patient was found dead in bed with its mother three weeks after treatment was begun. In the second case (in ten weeks) and in the third (time not given), the child was prac-

tically well when the treatment was abandoned. The treatment was begun early, and in ten weeks the passive motion could have stretched the recent cicatricial tissue easily, and with the massage could have aided materially in the absorption of the reparative new tissue and adhesions of the nerves, the condition of which was probably improved by the electricity. An injury to the roots of the brachial plexus would probably not have recovered so quickly.

Guillemot¹² reports a remarkable series of 12 cases, observed between the ages of fourteen and twenty-five years. The histories showed that all had been delivered either by podalic version or by the breech, and by the same midwife. In 7 cases both arms were paralyzed and in 5, only one arm. Internal rotation was noted in 15 arms, and in 4 it was not observed. Scapulohumeral ankylosis was positive in 13 shoulders, slight in 1, and probably present in the remainder, judging from the associated statements. The paralysis was observed within a few days after birth in all but 2, and in connection with these no statement was made showing when it was first noted. In many of the cases there were associated joint lesions in the shoulders, elbows, and wrists, proving conclusively, says Guillemot, that strong traction must have been made on the arms in delivery. That the condition of the arms was not due to myelitis, was indicated by the fact that in all, the patellar reflexes were normal and in none was there any weakness in the lower extremities. Sensation was better preserved than motion, and in several cases in which the paralysis was almost total, there was neither anæsthesia nor analgesia. In 11 cases the history pointed to a breech presentation. It will be recalled that of Schoemaker's 95 cases, 55 were head presentations and 40 breech, although for all labors the former are relatively much more common than the latter. The evident relationship between breech presentations and birth palsies has been explained upon the basis of the traction on the after-coming head, and consequently upon the cervical roots of the brachial plexus. It has been shown that the palsy frequently occurs when the birth has taken place without traction on the head. In a breech presentation, when the body is

delivered the arms are forced into extreme abduction alongside of the after-coming head, and any turning of the body to one side or the other to assist in the delivery of one arm throws that arm into still more marked abduction. The danger to the capsule is then extreme, so that skill and care would be required to avoid its rupture. The associated joint lesions of the shoulders, elbows, and wrists proved conclusively that strong traction was made on the arms in delivery, as Guillemot said, not on the head.

The main point that I have tried to make is that the pathology underlying many of these brachial birth palsies is that of a dislocation of the shoulder, or its analogous condition, a sprain. The paper of Schulz and that of Delbet and Cauchoix emphasize the importance of the dislocation, in similar cases not occurring immediately after birth. I believe that a careful search of the literature would show that it bears an equally important relation to the birth palsies. Lewis¹³ reported a case, which had been diagnosed as a birth palsy and in which a posterior dislocation was recognized and reduced. The patient recovered full use of the arm. Young¹⁴ reported a similar case and directed attention to the frequency with which dislocation of the shoulder is mistaken for birth palsy. He adds that if the dislocation is allowed to continue it will produce a pressure palsy resembling a birth palsy.

Through the kindness of Dr. R. H. McCombs, registrar of the Children's Hospital of Philadelphia, I was enabled to trace a case of brachial birth palsy, which had appeared at the dispensary of this institution, July 18, 1906, when three years of age, on account of an inguinal hernia. It was noted in the history that the patient had a birth palsy of the right arm. He never returned to the dispensary. He is now seven years old. From the mother I learned that instruments had been employed at birth, and that the left humerus and the right clavicle had been fractured, showing that strong traction had probably been made on the arms in delivery. On the following day the right arm was observed to hang helpless at the side. At two months of age, he was taken to a nervous dispensary of another hospital, where the attending physicians are particularly competent to recognize a

birth palsy. The visits were not continued long, as the child was too young. At eight months, he was taken back to the same hospital, and again received electrical treatment, which seemed to indicate that a diagnosis of birth palsy had been made, but the mother was never told what was wrong with the arm. When I found him, recently, the arm was hanging at the side, rotated internally, and considerably shorter than the opposite arm (see Figs. 1 and 2). He had regained considerable power, and could abduct the arm to an angle of about 140 degrees. The limitation was due chiefly to a mechanical obstruction at the shoulder, but for which he could probably have raised his arm in full abduction. There was a well-marked wrist-drop and an evident atrophy of the deltoid. Dr. J. W. McConnell, by electrical examination, found a paralysis of the musculospiral nerve. The parents had never been told by any one that the child had a dislocation of the shoulder. Upon inspection the picture was that of a brachial birth palsy, but after palpating the shoulder carefully because of a peculiarity in its shape, I detected a subacromial dislocation. The humeral head could be pushed forward, evidently into the glenoid cavity, but not as far forward as normally. It would not stay in this position if the pressure was removed, and could not easily be held there when the boy abducted or adducted his arm. It seemed to be more easily fixed in the normal position when the arm was in abduction. The patient's brother, now about twenty-five years of age, insisted that he had observed from the birth of the patient that the shoulder was out of place.

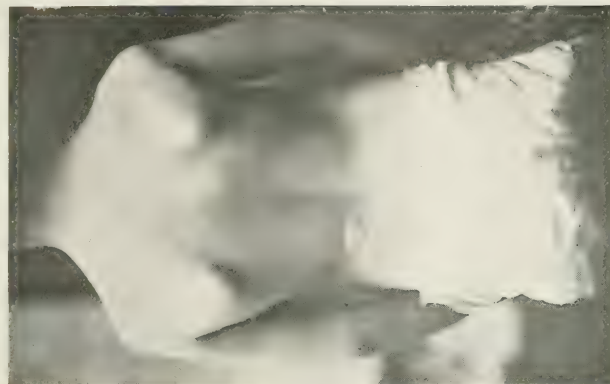
On October 28, 1910, he was admitted to the service of Professor J. William White, in the University Hospital, and on the following day I operated on him. The incision was made along the posterior border of the deltoid, which was retracted upward. The tendon of the infraspinatus muscle was divided transversely, the capsule exposed, and the joint opened. The glenoid surface had not the normal cup shape, but was rather convex, with a tendency to slope backward, favoring the slipping posteriorly of the humeral head into the dislocated position. The head was placed in its normal position and the arm held at a right angle with the body while the capsule was shortened to hold the head in this position. The infraspinatus tendon was repaired by suture, and the wound closed without drainage. After the dressings were applied the arm was fixed in nearly full abduction by a light plaster cast, and an opening left through which the

FIG. 1.

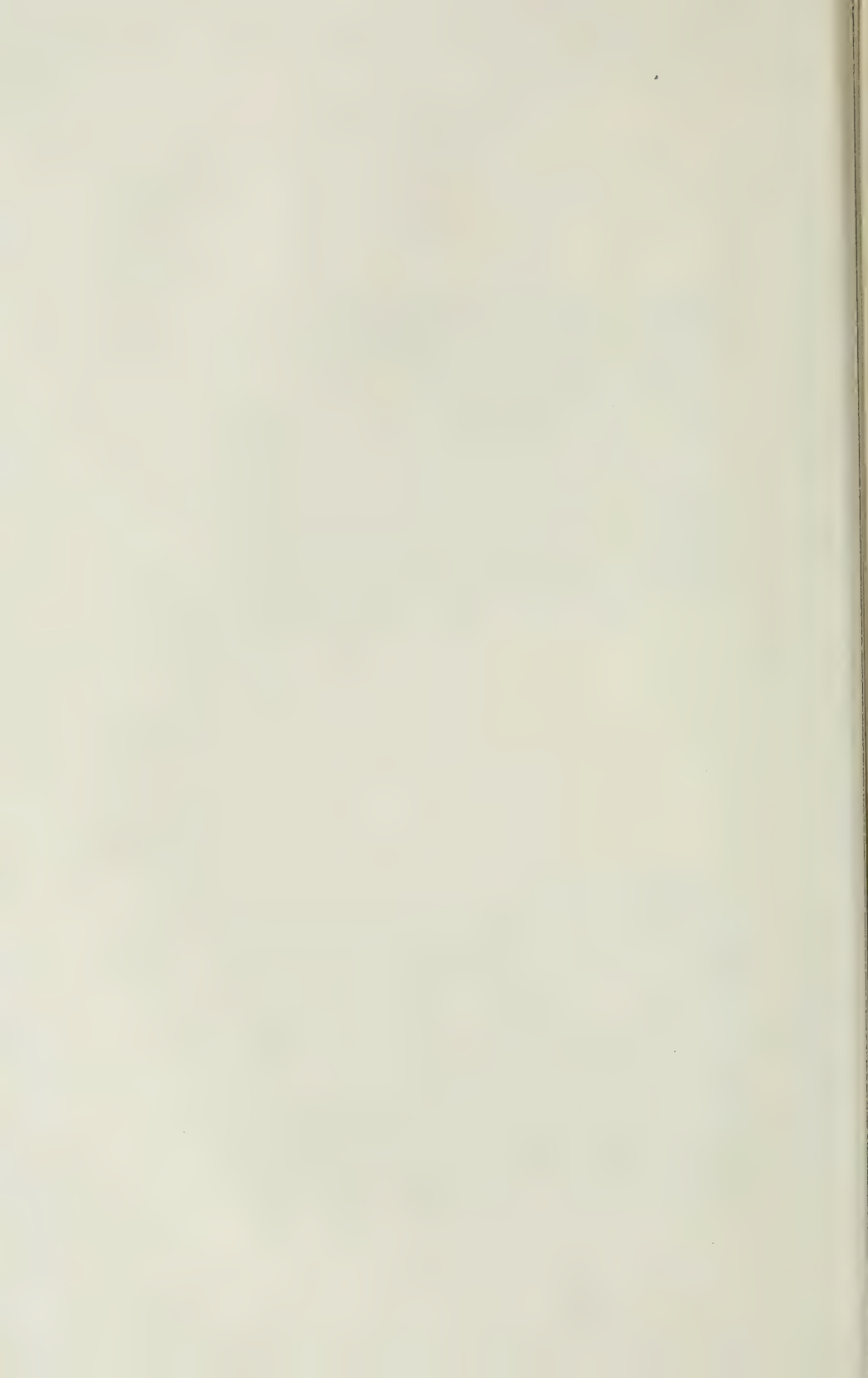


Subacromial dislocation of right shoulder, with paralysis of musculospiral nerve. Anterior view. The wrist-drop, shortening of limb, and internal rotation of arm are shown. There is an abnormal prominence at the site of the old fracture of the clavicle.

FIG. 2.



Posterior view. A, abnormal prominence produced by dislocated humeral head. Position of hand shows internal rotation of arm.



wound could be exposed. Healing occurred by first intention and the skin sutures were removed on the seventh day. On about the twelfth day the patient developed symptoms of scarlet fever and was removed to the Municipal Hospital. The cast was there removed two weeks after operation. In about a week the arm could be brought to the side of the body, and the patient was permitted to use it as he lay in bed. On September 2, I saw him at the Municipal Hospital, and then observed that the dislocation was recurring, the tendency of the humeral head being to force its way back to the dislocated position, probably on account of the abnormal shape of the glenoid cup. There was evident at this time a marked improvement in the muscles supplied by the musculospiral nerve, as shown by the disappearance of the wrist-drop. When both arms were held out from the body, the hand on the affected side was held in exactly the same position as on the sound side, *i.e.*, with the palms facing downwards, both hands were in dorsal flexion at the wrist and on the affected side was held in this position without any apparent difficulty. I believe that this degree of improvement in the musculospiral nerve, during the few weeks in which the humeral head was kept in the normal position and the nerve thus probably relieved of abnormal pressure, proves that if the humeral head can be kept in its normal place the arm will become much stronger and a very useful member.

We have here another case like those of Lewis and of Young, in which a posterior dislocation of the shoulder occurring at birth was mistaken for a birth palsy. The clinical picture of birth palsy was present in all three. They show, I believe, that there is a close etiological relationship between the two conditions.

Similar palsies in the adult, from trauma about the shoulder, are due in the great majority of cases, I believe, to tears of the axillary portion of the capsule. While probably true, this is not so clear in the accidents of birth involving the upper extremity. Forced abduction tends to produce an anterior dislocation, but that occurring at birth is almost always posterior. Forced abduction tears the axillary portion of the capsule, but what is the relation between this and a posterior dislocation which must tear the posterior portion also? The following explanation may have some value. There is one im-

portant difference in the forced abduction applied to the infant's arm at birth and that applied to the arm in the usual accidents in adults. In the adult the limb is used for defense and is placed or employed by the patient himself, according to the nature of the accident. In the infant at birth, the limb is used as an aid in delivery and is controlled by a second person. In a fall on the hand, which is probably the most frequent cause of dislocations of the shoulder in adults, we have, in addition to the forced abduction, a push in the long axis of the limb in the direction of the shoulder. At birth, assuming that traction on the arm is the cause of the dislocation, we have, in addition to the forced abduction, a pull in the long axis of the limb, away from the shoulder, a force directly the opposite to that sustained in a fall on the hand which produces an anterior dislocation. Since the long axis of the glenoid cavity is oblique from above downward, a strong pull on the fully abducted arm should tend to produce an upward and backward dislocation.

The three cases I have referred to would seem to indicate that a posterior dislocation of the shoulder in the new-born is usually associated with a palsy. If the same condition developed in the absence of a dislocation it would probably be called a birth palsy. Why not in the presence of a dislocation? Stimson says that paralytic dislocations of the shoulder are particularly frequent in the new-born, and that Duchenne saw eight of this kind in ten years. Panas quotes Duchenne as saying that before his attention was attracted to this complication, he had overlooked it in other cases. According to Panas, Duchenne called attention to the fact that there was diminution of electrical contractility and atrophy of the muscles supplied by the musculospiral and ulnar nerves in these cases. As already stated, I have failed to obtain access to Duchenne's contribution on this subject. In my opinion, there is room for question as to whether all of these dislocations are paralytic, *i.e.*, that the dislocations are the result of associated paralysis. I believe that in my case it was not, but that the paralysis was the result of the dislocation. The reduction of the dislocation in the case of Lewis and in that of Young was followed by a disappearance of the paralysis. In my case the dislocation has existed so long that more or less permanent changes may have

taken place in the nerves and muscles, and a return to the normal may be impossible. The prompt improvement following operation, however, is very encouraging. I believe, however, that if the dislocation had been recognized at birth or soon afterwards and had then been reduced, a complete cure would probably have followed. The only positive nerve paralysis at the present time, after the dislocation has existed seven years, is in the musculospiral. Could the dislocation be responsible for this isolated paralysis? The course of this nerve and its relation to the humerus is peculiar to it. In the lower part of the axilla, it begins to pass backward, and then passes obliquely around the upper half of the humerus close to the bone. The backward dislocation of the upper end of the humerus forces the nerve backward with it and must exert an abnormal compression on it, the seven years' existence of which might be responsible for the present condition of the nerve and the muscles it supplies. The results of operation in this case would seem to support this view. Those cases in which there is a depression between the acromion and the humeral head, the joint flail, and the muscles paralytic, are relatively common soon after birth, but as already stated I expect to take up this subject in another paper, so that I shall avoid its discussion now.

Believing as I do, that in tears of the axillary portion of the shoulder capsule we have a hitherto unrecognized cause of many nervous disturbances in the upper extremity, the pathology of which has been in doubt, I feel justified in suggesting a possible relationship between this injury and some of the craft palsies. In a previous paper¹ I reported a case of stiff and painful shoulder with loss of power in the arm, in which diagnoses of neuritis and of osteo-arthritis were made. The patient is a well-educated man, who was disposed to investigate and to interpret, so far as possible, the meaning and cause of the symptoms of his condition. He was first in the hands of a physician for some months, who was anxious to discover the underlying cause of the trouble, and I had examined the arm for the first time; yet none of us had suspected the existence of the marked scapulohumeral ankylosis, the gradual elimination of which was followed by a disappearance of all the

troublesome symptoms. In connection with this case we might consider the one previously mentioned, in which the palsied hand movements returned almost to the normal, so far as freedom of movement was concerned, immediately after the tearing of the contracted portion of the shoulder capsule. If in the second case, as in the first, the trouble in the shoulder had not been recognized, and the patient had been a clerk whose livelihood depended upon the use of his hand in writing, I can imagine the weakness in the hand attracting most attention. I have already reported a case, in which both shoulders were stiff and painful from rheumatism, and in which in one arm a diagnosis of writer's cramp was first made, then of neuritis of the arm by another physician, and of dislocation of the shoulder by a third physician, which was probably the cause of the aggravated condition in that arm. Turner and Stewart¹⁵ say that in some cases the pain is occasionally severe, and affects the upper arm and shoulder as well as the forearm and wrist. They also say that examples of occupation neurosis are seen in men who undergo repeatedly muscular efforts, as blacksmiths, in whom the upper arm and shoulder muscles, especially the triceps and deltoid, are implicated. Poore¹⁶ says that he recalls cases of writer's cramp in which excessive efforts with a crow-bar, pulling hard upon a rope on board ship, wringing of clothes, and severe traction on one arm while getting off an omnibus in motion were each followed by an inability to perform delicate acts. In the discussion which followed the reading of a paper by Poore¹⁷ on writer's cramp, Godlee referred to a case which had a clicking in the shoulder and a good deal of pain, apparently muscular. The shoulder was supposed to be diseased, as the result of an injury, but Godlee could not make it out as diseased. It would seem, therefore, that many of the craft palsies are distinctly traumatic in origin. It will be recalled that in many of Schulz's cases, which followed dislocations of the shoulder, movements absolutely necessary for many occupations could not be performed at all or only to a slight extent. It is not necessary that the scapulohumeral ankylosis be marked, to be associated with severe pain and weakness in the arm as I have seen in

one case. The blood, lymph, and synovial fluid, which extravasated about the large nerve-trunks soon after the original accident, may have induced sufficient adhesions about them to interfere with their functions, and therefore with the functions of the muscles they supply; or as already stated, the weakness in the extremity, including the hand, may be due to the limitation of motion at the shoulder. Erb says of these cases that electrical examination, as a rule, shows no noteworthy changes, and that we are still very much in the dark with regard to their real nature.

The following case, seen recently with Dr. R. S. Dorsett, is very suggestive. The patient, a trained nurse, was thrown violently in a street car collision, striking, she says, against her right shoulder. In consequence she suffered severe pain in various parts of the body, but particularly in her left arm, left leg, and in the back between the scapulæ. I saw her for the first time 26 days after the accident. She then had considerable tenderness on pressure between the scapulæ, and since the accident had suffered from pain and numbness in the left upper extremity from the shoulder to the hand, where it involved the three fingers on the ulnar side. An important part of her work is the giving of massage and her chief complaint at the present time is that the loss of power in the left hand interferes with her ability to perform the massage movements. She is very much worried also because, from time to time quite unconsciously, she drops objects from her hand, such as a drinking glass, recognizing the fact only when the crash of the fallen object is heard. In order to establish or exclude a tear of the axillary portion of the capsule, the first symptom I looked for was scapulohumeral limitation of movement, and I found that full movement at this joint could be performed, actively as well as passively. It was not until a week later, on her second visit, that it occurred to me to ask if there had been any pain on movement in the shoulder, and she then stated that she had had much trouble in this respect, but that she had persisted constantly since the accident in forcing the painful and limited abduction. It was only for a few days before her first visit to me that she had been able to perform the full movement. I diagnosed a slight tear of the capsule on the left side, with the possibility of a similar but still milder lesion on the right side. The tenderness between the scapulæ was over

the back muscles, which would most resist the associated movements of the scapulæ in forced abduction at the shoulder, which I believe occurred in the original accident. There was more acute tenderness in the left axilla directly under the joint than anywhere else in the body, and I thought that there was still a slight trace of ecchymosis in this axilla, more than three weeks after the accident. About six weeks after the last visit she returned and complained that she could not voluntarily abduct the arm beyond a right angle. On account of pain in the shoulder she had neglected to continue the forced exercises, and the recurrence of the scapulohumeral limitation was the result. The pain and numbness down the arm and forearm to the hand, and the loss of power in the hand, could be satisfactorily explained by a perineuritis and neuritis of some of the branches of the brachial plexus, particularly of the ulnar nerve, due to inclusion in the inflammatory area adjacent to a tear in the axillary portion of the shoulder capsule.

The important fact here is that, four weeks after the accident, when there was little or nothing to suggest a nerve lesion in the axilla, the palsy of the hand should be so marked as to seriously impair her ability to follow her usual occupation, and to cause her to drop such light objects as a drinking glass. There is no doubt in my mind that the weakness in the hand was due to the shoulder-joint lesion, and it seems to me that the case might be classed with the craft palsies. The patient did not associate the hand weakness with the shoulder condition, but regarded it as one of a number of isolated effects of the accident, among which are the pain in the leg, in the back, about the shoulder, and the pain and numbness in the arm and forearm.

Concerning the treatment of these cases, I would place the emphasis first on overcoming the scapulohumeral limitation of movement by suitable exercises and massage, the condition of the nerves and muscles at the same time being improved by electrical stimulation. I would prefer to delay the final determination of the presence or absence of an actual rupture of nerve-fibres and the localization of such a lesion until the movements of the shoulder-joint were normal and the effects of compression or adhesions of nerves had been eliminated.

The early recognition of a joint lesion and the associated axillary inflammation is of the greatest importance, but it is likely that the majority of the cases will continue to escape recognition until the conditions become chronic. I have gone over the treatment more fully elsewhere ¹⁹ and will now only briefly review it.

In the acute stage, the severity of the pain on movement may demand immobilization of the shoulder-joint. This is done preferably with the arm in full abduction, to prevent contraction of the torn capsule during the healing process, which should be complete in two weeks. This position is awkward, uncomfortable, and difficult to maintain, but the result is well worth the trouble it involves. The Monk splint modified by Codman ² is a good one for the purpose. A light plaster cast, including the upper part of the chest and arm to the elbow, will permit more complete abduction, more complete rest of the joint, and will not require as much care as the splint. If there has been a dislocation of the shoulder, it will probably be safest to bind the arm at the side, for three weeks, although I believe that a recurrence could be prevented with proper support by adhesive plaster and a splint which would hold the arm at a right angle with the body. The studies of Schulz show, in my opinion, that the fear of a recurrent dislocation is chiefly responsible for the frequent long-continued stiffness of the shoulder-joint and loss of power in the extremity. I believe that we should balance the one danger against the other, and that with due precautions we can largely eliminate both. At the end of two weeks' immobilization, when there has been no dislocation, the arm should be gradually brought to the side of the body, after which massage and passive movements should be employed to bring about an absorption of the inflammatory material in the axilla, the release of any adhesions which the nerves and other structures have contracted, and thus the return of motion in the joint and of power in the muscles. Electrical stimulation will aid in the more rapid return of the nerves and muscles to the normal.

If the patient is young, strong, and ambitious, the awkwardness of the fixation of the arm in the abducted position may be avoided by permitting him to keep the arm at the side,

but with the understanding that forcible exercises are to be employed as soon as the pain will permit and before contraction of the cicatricial tissue sets in. Most cases are first recognized as a serious condition in the chronic stage, when the cicatricial tissue in the axilla is firmly contracted and very resistant. Persistent and long-continued massage and forced movements may gradually stretch the contracted capsule to its normal length, but this will take such a long time that most patients will become discouraged and give up the treatment before it has accomplished the desired result. The breaking up of the resistance under an anæsthetic at one sitting, and the employment of measures to prevent a recontraction of the torn tissues have been very successful in the hands of a few men. Küster¹⁸ found it necessary to repeat the breaking up process frequently in some cases, but this was evidently because he dressed the arm at the side of the body afterwards and permitted the recontraction of the capsule, which could then, however, be stretched more easily because the inflammatory material was more recent and yielding than before the manipulations had been carried out. Küster regarded some very old cases as intractable. I have used this treatment in four cases with very satisfactory results and have not found it necessary to anæsthetize the patient the second time, and I believe that the method will be successful, however old the condition may be. The same efforts as in the acute stage must be made to maintain abduction or to overcome any recontraction, because what we accomplish by the forced manipulations is to produce essentially the same conditions as existed immediately after the original accident.

There are some cases in which the chief complaints are of pain radiating down the arm and loss of power, and in which the movement of the shoulder is so free as to cause a slight scapulohumeral limitation of movement to be overlooked. These are particularly likely to pass for cases of neuritis. In one case of this kind I was satisfied that there was slight abnormal movement of the scapula on passive abduction, and that a contracted axillary portion of the capsule with associated adhesions of the neighboring nerves was responsible for the trouble, which had persisted for eight months and had pre-

vented the patient from following his usual occupation, that of a machinist. Under an anæsthetic I forced the arm into full abduction at the shoulder, with the usual tearing sensation, fixed it in abduction on a splint for a few days, and afterwards forced it twice daily into full abduction. Massage was employed daily, and in six weeks he had obtained nearly full motion, much improvement in power, and was able to return to work at his trade. The slightly contracted capsule was in all probability responsible for most of his trouble. It has not been convenient to employ electricity in some of my cases, but where I have used it there has seemed to be a more rapid return of power in the weakened muscles. Whenever there is, in the muscles, an impairment of irritability to the electric current, its advantages are obvious.

In connection with the brachial obstetrical palsies, I have had only small experience, but I have been impressed with the idea that care is necessary in differentiating the various cases. I am convinced that subacromial dislocations frequently co-exist and are overlooked, and that they are probably birth palsies as much as those in which there are no dislocations. I believe that the dislocation had not been recognized in my case before I saw it. The prompt improvement in the condition of the paralyzed muscles after the imperfect result of the operation proves, I believe, that if the humeral head can be kept in its normal position without impairment of the movement of the joint, the condition of the muscles and nerves will return almost to normal. If the dislocation had been reduced soon after birth, when the glenoid cavity had its normal conformation, in all probability it would have remained in place, and, after a longer or shorter period of "paralytic" symptoms such as probably follow all dislocations and vary according to the degree of involvement of the neighboring nerves by the surrounding inflammation and the effects of later adhesions and compression, the arm would have gradually returned to its normal condition. I would interpret the existence of a scapulohumeral ankylosis in a case of infantile obstetrical palsy to mean that the cause of the paralysis was below the clavicle, not above it. The treatment in such cases should aim at improving the motion of the joint, and in this way releasing the

adjacent nerves from the effects of the adhesions and compression which interfere with their function. Electrical stimulation and massage are important in improving the condition of the arm. If after the normal joint motion has been obtained and a reasonable period has been allowed for recovery of the nerves, the paralysis is still of such a character as to justify the diagnosis of a permanent paralysis of one or more nerves below or above the clavicle, the advisability of an operation to free the nerves of their adhesions or to excise a portion and suture the divided ends together may be considered.

CONCLUSIONS.

Extensive laceration of the axillary portion of the capsule of the shoulder always occurs in anterior dislocations of this joint, which represent practically half of all the dislocations of the body. Probably, while the arm is in forced abduction, many others occur, which are spontaneously reduced as the arm falls by gravity to the side of the body immediately after the accident, and the fact of their occurrence is never recognized. Just as the milder lesion, the sprain, is more common at the ankle and wrist than the fracture, which results from a similar but more severe force, so, in all probability, are the sprains at the shoulder more common than the dislocations. We can thus account for a large number of cases in which the same capsule tear occurs.

The extravasation of blood, lymph, and synovial fluid, resulting from such a lesion, falls by gravity into the loose tissues of the axilla, where they surround and infiltrate some or all of the branches of the brachial plexus, giving rise to a non-infectious inflammation, which adds to the already existing compression of the nerves and induces a perineuritis and neuritis. The interference with the function of the nerves caused by these conditions can account for the multiplicity of the nerve symptoms and the fugaciousness of certain symptoms, so that one need not assume the existence of a traumatic lesion of the brachial plexus, its roots, or its branches, to account for them. The post-mortem and operative findings in Delbet and Cauchoix's cases, and the clinical findings in Schulz's cases, support this pathogenesis.

The infantile obstetrical palsies, in which one or both upper extremities are involved, may be the result of a similar axillary condition. This implies that forced abduction of the arm, with or without traction on it and not traction on the head, is the important causal factor. Dislocations at birth give rise to similar palsies, and in these capsule tears undoubtedly occur. The palsies associated with these dislocations are probably completely curable by the recognition and reduction of the dislocations soon after birth.

We may have in unrecognized capsule tears the pathological explanation of many craft palsies. In this connection they at least deserve further consideration.

In traumatic brachial paralyses in adults, in infantile obstetrical, and in craft palsies, the shoulder-joint should be examined for a traumatic lesion, and if evidence of it is discovered, such as a scapulohumeral limitation of movement, the first therapeutic efforts should be directed towards obtaining a return of normal motion in the joint. Operations on the brachial plexus, its roots, or its branches should be deferred until a paralysis from inclusion of the nerves in cicatricial tissue has been eliminated.

REFERENCES.

- ¹ American Journal of the Medical Sciences, 1911.
- ² Bost. Med. and Surg. Journ., 1906.
- ³ Deut. Zeit. f. Chir., 1908, lx, 333.
- ⁴ Revue de Chir., 1910, xxx, 673.
- ⁵ Revue de Chir., 1910, xxx, 817.
- ⁶ Zentralbl. f. Chir., 1910, xxxvii, 771.
- ⁷ De l'électrisation, 1871, 3d edit.
- ⁸ Johns Hopkins Hosp. Bull., Nov., 1910, 279.
- ⁹ Zeit. f. Geburtshülfe u. Gynecolog., Bd. xli, Heft 1, 1899, 33.
- ¹⁰ American Journal Medical Sciences, 1905, 670.
- ¹¹ Journ. Ment. and Nerv. Dis., N. Y., 1895, xxii, 702.
- ¹² Annales de Gynecolog., 1897, xlvii, 35.
- ¹³ Med. News, Phila., 1895, lxvi, 183.
- ¹⁴ ANNALS OF SURGERY, 1905, xlii, 777.
- ¹⁵ Text-Book of Nervous Diseases, 1910, pp. 510-511.
- ¹⁶ Allbutt's Syst. Med., 1900, vol. viii, 3-26.
- ¹⁷ Proc. Roy. Med. and Chir. Soc., London, 1885, vol. ii, 248.
- ¹⁸ Archiv f. klin. Chir., 1902, lxvii, 1013.

DISINFECTION OF THE SKIN BY TINCTURE OF IODINE.*

BY CHARLES L. GIBSON, M.D.,

OF NEW YORK,

Surgeon to St. Luke's Hospital.

IODINE in various forms has been employed in surgical practice for many years, and its value as a skin disinfectant has always been appreciated by some surgeons. An Austrian colleague tells me that he has resorted to it for fifteen years.

Its special usefulness as a skin disinfectant was brought to my attention by the article of Grossich in the *Zentralblatt für Chirurgie*, 1908, page 1289. Many others were doubtless influenced by this contribution, as the more general use of iodine seems to date from its appearance.

Grossich emphasized particularly the value of the tincture of iodine as an immediate disinfectant in emergency wounds, especially of the soiled extremities of the laboring class, with whom the usual prolonged and repeated procedures for the mechanical removal of dirt were out of the question.

I began to use the method tentatively in selected cases, and finally in October, 1909, adopted it as the routine method of sterilization of the skin, both in hospital and private practice. The year's trial finds me thoroughly satisfied with it, and I believe it is better than any of our former methods for the following reasons:

The results are fully as good and probably better than with any other means of sterilization of the skin familiar to me.

Its greater efficiency in emergency cases.

Its absolute simplicity—saving time, labor, and expense for ante-operation dressings.

The avoidance of discomfort and psychical disturbance to

* Read at the meeting of the New York Surgical Society, Dec. 14, 1910.

the patient in abolishing the trying and oftentimes terrifying "preparation."

The suppression of the painful and dangerous dermatitis frequently provoked by soap poultices and antiseptic solutions.

The drawbacks are: theoretically blistering and desquamation may follow, but if the method is applied as I describe it, these are reduced to a negligible minimum.

The method which I have established in my service at St. Luke's Hospital is as follows, a variation existing between deliberately planned operations and the more urgent: When time allows the patient should be shaved *the day before* operation in the ordinary manner with soap lather, which is then washed off. The usual rule in hospital practice of giving a patient a full bath if his condition permits need not be modified, provided always it is a day *before* operation.

After the shaving *nothing* more happens till the patient has been placed on the operating table the next day and primary anæsthesia has been obtained. (It should be emphasized that the patient is on the operating table and *not* on a stretcher or couch, involving handling and disarrangement of the operative field in the transfer to the table.) The anæsthesia should also be sufficient to allow the patient to be easily maintained in the proper position. The surface to be sterilized, *e.g.*, the whole abdomen, no matter where it is proposed to incise, is exposed and *one coat* of the official tincture of iodine is applied with any suitable material, such as a gauze "wipe." Paint brushes or other means which are used on several patients are to be avoided.

The iodine should be allowed to dry spontaneously; as much as five minutes may be required, the greater degree of dryness obtaining the less easily the iodine will be removed by subsequent handling. The area so treated must remain fully uncovered during the drying, and the attempts of the nurses to encroach on it with their application of towels and "drapery" must be discouraged.

When well dry, the surface not necessary for the actual operating space is suitably covered with dry towels.

At the end of the operation another quite light coat is applied to the immediate proximity of the incision. On very delicate skins this step will be wisely omitted.

Second Method.—For the class of cases whose operation is scheduled to take place immediately, that is, within less than twenty-four (approximately) hours' preparation, no water or watery solutions must come in contact with the area to be iodinated, and shaving, if any, must be done *dry*. It has been found by experiment and observation that the swelling of the superficial layers of the skin by imbibition of water prevented the penetration of the tincture of iodine. Grossich's experience is very illuminating: with dirty areas and no washing, primary union; ordinarily clean surfaces, plus washing, frequent failure of aseptic healing.

The method I have just described may seem so ridiculously simple that wonder will be probably expressed that it should be stated with such prolixity. Experience has shown that in hospital practice it is extraordinarily hard to replace complex or traditional methods by simpler ones. It took months to overcome the ingenuity and wiles of house staff and nurses, who would persist in using some part of the discarded procedures or try to introduce modifications based on some fantastic theory of improvement.

I note also in visiting other institutions that the methods of applying the iodine vary a good deal. Recently I saw it applied as a third coat on the operating table, the intervals of application being of some hours.

One operator tells me he has stopped using iodine because it prevents his judging of the tension produced by tying of the skin sutures.

In the year ending October 1, 1910, in my service at St. Luke's Hospital, the iodine has been used as just described in all of the thousand and odd operations where disinfection of the skin is feasible, but exception is made of the scalp, scrotum, and perineum, as so far I have judged it prudent not to risk the more severe irritations likely to occur in these regions.

The results have been uniformly good. About the only infections occurred in some salpingitis cases with large abscesses; these have always given us some trouble with the wound healing.

I think the best comparison of the merits of these methods of disinfection must be in the general activity of the service. I have only a small number of beds which are constantly in demand; this last year's list of operations is the heaviest I have ever had, and could not possibly have been obtained unless we constantly had had successful and prompt wound healing.

DRY IODINE CATGUT.

A FURTHER CONTRIBUTION UPON THE SUBJECT, WITH AN IMPROVED METHOD
OF PREPARATION.

BY ALEXIS V. MOSCHCOWITZ, M.D.,
OF NEW YORK,

Visiting Surgeon Har Moriah Hospital; Adjunct Attending Surgeon Mount Sinai Hospital.

IN a previous communication¹ I recommended a modification of the Claudius catgut, whereby the gut is used dry instead of wet. For over six years this catgut has been in constant use by nearly all the surgeons connected with Mount Sinai Hospital, and has amply demonstrated that it possesses all the necessary qualifications of an ideal ligature and suture material. Unfortunately, about a year ago, the source of supply of our raw material went out of existence, and the catgut prepared from material from other firms, though better to look at and considerably more expensive, was soon found to be deficient in tensile strength. The other qualities of dry gut were, however, so satisfactory that we were loath to give up the use of iodine catgut entirely, and I therefore set myself the task to devise, if possible, a method which would render the poorer qualities of the raw material as serviceable as the original.

It seemed to me that the only ingredient in the original solution of Claudius which could cause a loss in tensile strength of the catgut was the water. Recognizing the tanning and preservative powers of alcohol, I determined to substitute this fluid instead of the water in the immersion fluid. After immersing catgut, therefore, in various alcoholic iodine solutions for different periods, and allowing the catgut to dry, I tested the tensile strength and found that at the end of six months it was not impaired, if anything, particularly the smaller sizes (Nos. 1 and 2), increased.

¹ ANNALS OF SURGERY, Sept., 1905.

Before using it clinically, it was manifestly essential to show that the catgut was sterile. For this purpose I carried out the following bacteriological tests, at the bacteriological laboratory of Mount Sinai Hospital:

Series 1.—I prepared a quantity of catgut in the following manner: Catgut of the sizes known in commerce as Nos. 0, 1, and 2 was rolled on glass spools and placed into 5 per cent. and 2½ per cent. alcoholic solutions of iodine. From these solutions the catgut was removed at one-day intervals, allowed to dry, and labelled No. 0, 1, or 2—5 per cent. or 2½ per cent.—1-, 2-, 3-, 4-, or 5-day catgut respectively.

Dec. 2, 1909, pieces of the catgut prepared by the above method, about one inch in length, were inoculated into tubes of bouillon, and placed in the thermostat. Daily observations were taken for eight days, and the following results obtained:

	Dec. 3.	Dec. 4.	Dec. 5.	Dec. 6.	Dec. 7.	Dec. 8.	Dec. 9.	Dec. 10.
No. 0 ¹ , 5 per cent. ² , 1 day ³	— ⁴	—	—	—	—	—	—	—
No. 1, 5 per cent., 1 day.....	—	—	—	—	—	—	—	—
No. 2, 5 per cent., 1 day.....	—	—	—	—	—	—	—	—
No. 0, 2½ per cent., 1 day.....	—	—	+	+	+	+	+	+
No. 1, 2½ per cent., 1 day.....	—	—	—	—	—	—	—	—
No. 2, 2½ per cent., 1 day.....	—	—	—	—	—	—	—	—
No. 0, 5 per cent., 2 days.....	—	—	—	—	—	—	—	—
No. 1, 5 per cent., 2 days.....	—	—	—	—	—	—	—	—
No. 2, 5 per cent., 2 days.....	—	—	—	—	—	—	—	—
No. 0, 2½ per cent., 2 days.....	—	—	+	+	+	+	+	+
No. 1, 2½ per cent., 2 days.....	—	—	—	—	—	—	—	—
No. 2, 2½ per cent., 2 days.....	—	+	+	+	+	+	+	+
No. 0, 5 per cent., 3 days.....	—	—	—	—	—	—	—	—
No. 1, 5 per cent., 3 days.....	—	—	—	—	—	—	—	—
No. 2, 5 per cent., 3 days.....	—	—	—	—	—	—	—	—
No. 0, 2½ per cent., 3 days.....	—	—	+	+	+	+	+	+
No. 1, 2½ per cent., 3 days.....	—	—	—	—	—	—	—	—
No. 2, 2½ per cent., 3 days.....	—	+	+	+	+	+	+	+
No. 0, 5 per cent., 4 days.....	—	—	—	—	—	—	—	—
No. 1, 5 per cent., 4 days.....	—	—	—	—	—	—	—	—
No. 2, 5 per cent., 4 days.....	—	—	—	—	—	—	—	—
No. 0, 2½ per cent., 4 days.....	—	—	—	—	—	—	—	—
No. 1, 2½ per cent., 4 days.....	—	—	—	—	—	—	—	—
No. 2, 2½ per cent., 4 days.....	—	—	—	—	+	+	+	+
No. 0, 5 per cent., 5 days.....	—	—	—	—	—	—	—	—
No. 1, 5 per cent., 5 days.....	—	—	—	—	—	—	—	—
No. 2, 5 per cent., 5 days.....	—	—	—	—	—	—	—	—
No. 0, 2½ per cent., 5 days.....	—	+	+	+	+	+	+	+
No. 1, 2½ per cent., 5 days.....	—	—	+	+	+	+	+	+
No. 2, 2½ per cent., 5 days.....	—	—	+	+	+	+	+	+

¹ Refers to the size of the catgut.

² Refers to the strength of the iodine sol.

³ Refers to the number of days of immersion.

⁴ — denotes no growth.

⁵ + denotes growth.

In view of the fact that all the experiments made with the 5 per cent. iodine gave a negative result, even after an immersion of only one day, while some of the experiments made with the 2½ per cent. iodine gave a

positive result, we have adopted for the preparation of the catgut a 5 per cent. alcoholic solution of iodine, and all subsequent experiments were made with that only.

Series 2.—Nutrient agar was poured into Petri dishes, and after solidification parallel streaks were made upon it with the following bacteria: *Bacillus subtilis*, *Staphylococcus aureus*, *S. albus*, *Bacillus coli*, *B. pyocyaneus*, *Streptococcus* and *Bacillus anthracis*. Upon these I placed irregularly three pieces of iodine catgut, approximately one inch in length, and kept in the thermostat. On the following days myriads of colonies developed, but none anywhere near the catgut. The space devoid of colonies was very large, much larger than the space around the aqueous iodine catgut. A further very interesting fact to be noted in these experiments and in Series 3 was, that the bluish-green color of the pyocyaneus dish became diffused into the clear area around the catgut, but no colonies developed.

Series 3.—Tubes of agar were liquefied and infected with *Bacillus subtilis*, *Staphylococcus aureus*, *S. albus*, *Bacillus coli*, *B. pyocyaneus*, *Streptococcus* and *Bacillus anthracis* and poured into Petri dishes. After solidification pieces of iodine catgut were placed upon it, and then put into the thermostat. Again myriads of colonies developed, but only at great distance from the catgut. In other respects the observations noted for Series 2 apply here also.

Series 4.—In order to show that the iodine contained in the catgut did more than merely temporarily inhibit the development of the bacteria, but also effectively destroyed them, a liberal piece of the agar at some distance, one-quarter to one-half inch, from the catgut in Series 2 and 3 was removed and implanted into bouillon, and also streaked on agar. The result was sterile in every instance, except in the pyocyaneus from Series 2, where evidently I was too far from the catgut.

Series 5.—To further prove that the iodine does more than inhibit the development but actually kills all bacterial growth, pieces of iodine catgut were placed into large quantities of sterile water, which was changed on four successive days and kept in the thermostat, and finally inoculated into bouillon. No growth followed in any instance.

This is also proven by the fact, that all our experiments were carried out in the thermostat for a number of days, and yet no growth developed, though it is a well-known fact that the heat of the thermostat alone would be sufficient to dissipate the iodine content in that time.

Series 6.—Pieces of Nos. 0, 1, and 2 catgut were placed into freshly prepared 48 hour-old bouillon cultures of *Staphylococcus albus*, *S. aureus*, *Streptococcus*, *Bacillus pyocyaneus*, *B. coli*, *B. subtilis*, and *B. anthracis*, and all placed for another 48 hours in the thermostat. At the end of that time the pieces of catgut were all markedly swollen and softened. They were then removed and placed for five days into a 5 per cent. alcoholic solution of iodine, then dried, and kept in sterile containers. In other words, catgut was purposely strongly infected with actively growing bacteria, and then sterilized with iodine. For the sake of recognition and simplicity this catgut received the name "Catgut X," and was utilized for the following experiments, repeatedly done:

Pieces of Catgut X in all sizes and of the seven varieties of bacteria before enumerated were placed in bouillon into the thermostat and observed for a number of days. In one set of experiments, one of the coli tubes showed a growth; in another set one of the anthrax tubes showed a growth; in a third and fourth set all were sterile. As I could recover from none of the infected tubes, by cultural methods, the original bacterium, I am forced to the conclusion that they were accidental contaminations, as is likely to occur when working with so large a number of tubes.

But the most surprising and in many respects the most convincing fact occurred in this series of experiments. I found, namely, in some of the tubes quite a heavy deposit. This deposit did not look and did not act like a growth, as by no amount of transplantation into various media was I ever able to get a fresh growth. By staining, however, I found, particularly beautifully in the spore-forming *Bacillus subtilis* and anthrax, that this deposit consisted of the bacteria of original implantation. This was very interesting, because it proved to me how effectually so large a number of bacteria were killed by the method of preparation.

This series of experiments was completed in December, 1909. My faith in the iodine sterilization was such that I did not hesitate to put it at once to the clinical test, and both Dr. Gerster and myself have continued to use it since that time with perfect satisfaction. From time to time, we run across a brittle spool, but this is so exceptional that there is no doubt but that particular strand of catgut is of a markedly inferior quality. This, however, occurs, and has occurred, with catgut prepared by any other method.

A word or two about the other physical properties of this catgut. It is of a dark reddish-brown, almost black color, and has to a marked degree the characteristic odor of iodine. It is rather stiff and wiry; we have become accustomed during the past six years to a dry catgut, and far prefer it to the smooth and slippery catguts in general use; those that prefer a softer catgut may immerse it in sterile water just before using it. It knots very firmly, and the knots do not tend to unravel like wet catgut.

Finally as to the preparation. Ordinary catgut, just as it is bought from the dealers (we give preference to the dark unbleached varieties) is wound onto the well-known glass spools, in a single layer, and fastened at both ends, so as to prevent

unravelling. It is then placed for five days into a 5 per cent. alcoholic solution of iodine in a tightly closed vessel (museum jar). On removal it is spread out on a sterile towel, covered by another sterile towel to facilitate drying, and is finally kept in a sterile container.

As is seen, this method is simplicity itself, requiring no expert help for its preparation. It is certainly very cheap, an item of no small importance, particularly in large hospitals, where large amounts are used. It is to be especially noted that of late we have used a catgut, the price of which was exceedingly low, compared with some on the market.

Finally I can only again emphasize the conclusions I arrived at in the publication already quoted.

"I believe that our clinical experience, and the experimental work related, fully justify the following conclusions:

"1. The dry iodine catgut is absolutely sterile.

"2. It is impossible to infect it by ordinary means.

"3. Its imbibition with iodine is not sufficient to act as an irritant upon the tissues.

"4. Its tensile strength is superior to catgut prepared by other methods. (I have purposely kept a number of spools from the lot first prepared, now over six months, and find its strength absolutely unimpaired.)

"5. It is easily and cheaply prepared.

"6. It is absorbed only after it has served the purposes for which it was intended."

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held October 3, 1910.

The President, DR. ROBERT G. LE CONTE, in the Chair.

OSTEOMYELITIS OF THE SACRO-ILIAC ARTICULATION.

DR. JAMES K. YOUNG reported the history of a youth, aged 17 years, with good family history and without pulmonary or other inherited disease, who was admitted to the service of Dr. David Riesman at the Philadelphia Polyclinic, with the statement that the day after Christmas he fell while playing and injured his hip; two weeks later he had another fall, injuring his left hip, and five days previous to admission he had another fall from a wagon. Upon admission he complained of pain in the region of the left hip, and there were tenderness, heat, and deep fluctuation in this area. The leg could be moved without much difficulty. His condition not improving and a leucocyte count of 14,600 being found, the sacro-iliac joint was exposed, a portion of the ilium was removed, and the hip-joint was exposed, but no pus was found. Within six hours, however, suppuration became profuse and continued for several days. The cultures showed *Staphylococcus aureus*. His recovery was interrupted by an attack of orchitis. The case is reported on account of the rarity of acute suppurative conditions of this articulation and their recovery under treatment.

EARLY (TREVES) OPERATION FOR PSOAS ABSCESS.

DR. YOUNG also reported the history of a boy, aged seven years, family history negative for tuberculosis or other inherited disease, who, two days before admission to the Polyclinic Hospital, began to bend forward on the right side and to complain of pain in the right hip, with night-cries. Upon admission the right thigh was flexed, the movements of the right hip-joint

were otherwise normal. There was tenderness in the right lumbar region with rigidity of the spine, but without any fulness in the iliac region. The osseous lesion of the spine was revealed by an X-ray, and the diagnosis of psoas abscess was made. The abscess was opened by posterior dissection after the method of Treves, six days after admission. In three days the temperature was normal and in twelve days from time of operation the wound was healed and the patient was discharged from the hospital wearing a fixation apparatus.

SACRAL LAMINECTOMY FOR TUBERCULAR MONOPLÉGIA.

DR. YOUNG also reported the history of a man, aged 38 years, who was admitted to the Polyclinic Hospital under the service of Dr. David Riesman suffering from an atrophy and pressure palsy of the left leg. He stated that several years before he had been injured by a horse. There was prominence of the spinous processes of the sacrum, with tenderness over this region. A laminectomy was performed, removing the second and third laminae and exposing the nerves. An examination of this bone showed the presence of bony tuberculosis. The wound was an oval flap incision with the convexity upward in order to diminish infection, and primary union was secured. The operation removed the pain in this region, but pain in the lower extremity was not entirely relieved.

LACERATION OF THE AXILLARY PORTION OF THE CAPSULE OF THE SHOULDER-JOINT AS A FACTOR IN THE ETIOLOGY OF TRAUMATIC COMBINED PARALYSIS OF THE UPPER EXTREMITY.

DR. T. TURNER THOMAS read a paper with the above title, for which see page 77.

DR. JAMES K. YOUNG said that where children have had a palsy of the upper extremity due to subglenoid dislocation of the head of the humerus, this condition is usually mistaken for nerve palsy, but he had frequently discovered the condition to be due to a dislocation at birth, which had persisted. In one case seen by him, in a very small child, the examination was not very satisfactory, but it was shown to be a subglenoid dislocation. In some cases there has been complete restoration of function, in others but partial restoration. After reduction of the shoulder

there is often difficulty with the elbow-joint for some anatomical reason, so that sometimes he had had to also reduce the elbow-joint after reducing the shoulder-joint.

He had performed other operations of this character on three occasions. He had opened the capsule posteriorly and shortened it, making it smaller laterally. This is an original operation, and is not difficult either anteriorly or posteriorly. The capsule is opened by longitudinal incision and a portion removed or folded in and sutured together. The suturing of the capsule is important to maintain the position of the shoulder-joint. He had also removed the tendency to dislocation by division of the contracted muscles. After reduction and shortening of the capsule, the head of the bone should lie in good position without much force. It should remain in position after reduction, and there should be no pulling on the muscles or ligaments, all being so free that the joint remains in position without their aid.

DR. T. TURNER THOMAS presented the boy with paralysis of the arm developing at birth, referred to in his paper. He found an overlooked subacromial dislocation of the shoulder, which he reduced by operation. In this case when he got his finger inside the joint, the glenoid surface was felt to be abnormal. That is, it was more or less convex, with an inclination from the anterior toward the posterior edge, tending to favor the sliding out of the head from its normal position. Yet this was not very marked. He wanted to see what a shortening of the capsule would do. In the two months since the operation, the dislocation has been recurring. The point had impressed him that the head ought to lie in place easily and it should not be necessary to depend upon the soft tissues to hold it in afterwards. In this case, however, it tended to force itself out, although it is not now out as far as previously by a good deal. He now proposes, if he can obtain permission, to do what a German surgeon, Hildebrand, did in two recurring dislocations of the shoulder, in which the anterior portion of the glenoid process was absent. The head tended to slide out of the socket anteriorly, so he chiselled away the posterior margin until he made a new socket with a raised anterior margin. Dr. Thomas would try to go in through the axilla and make a new socket in this case, so that the head would stay in place without pressure

upon the ligaments. The striking improvement in the condition of the musculospiral nerve in the short time in which the head was kept in its normal place, leads to the hope that if the head can be kept in place permanently, the boy will obtain a much more useful arm than he has at present.

DR. ASTLEY P. C. ASHHURST reported the following cases from the services of Drs. G. G. Davis and C. H. Frazier, in the Episcopal Hospital.

I. APPENDICITIS COMPLICATED BY SUBPHRENIC ABSCESS.

Lucy G., age 31 years, negro, admitted to Dr. Frazier's service in the Episcopal Hospital, Dec. 28, 1907. During the night of Dec. 26-27 the patient awoke with epigastric pain, which later centred around the umbilicus. She worked at general housework all morning. She took salts, which made her vomit. She went to bed at 2 P.M. Six enemas were administered, but they had no effect. The next day (Dec. 28), the patient was sent to the Episcopal Hospital.

On admission it was learned that the patient is married, has had two children, the last five years ago. For several years, and until five years ago, had almost constant indigestion, which was attributed to rich food. No indigestion for last five years. Never seriously ill before.

Examination.—Temperature 101° F.; pulse 124; white blood-cells 15,000. Abdomen distended all over and rigid, but especially on right, and more so in upper than in lower quadrant. Very tender everywhere, including *both flanks*. Dulness in right flank. Liver dulness extends a little higher than normal. On percussion, stomach is found distended, and transverse colon is at level of navel. Has not vomited since taking salts the previous morning. No bowel movement since illness began.

Operation.—Forty-four hours after onset of illness an incision was made through the right rectus, above the navel; free pus was revealed on incising the peritoneum. The incision was enlarged up to costal margin; more and more pus kept coming from right flank and from above the transverse colon. Gall-bladder distended, but otherwise normal. Lymph around cystic duct, pylorus, and on anterior wall of stomach. When field of operation was almost dry, suddenly there came a new flood of pus from above the right lobe of the liver, just beneath

the diaphragm; this pus was full of flakes of lymph. When it was all sponged away, the margin of the ruptured adhesions which formed the subphrenic abscess could be clearly seen on the convex surface of the liver. Counter-incision was made for drainage just above the tip of the twelfth rib, and a split rubber tube, filled with gauze, was passed from the abdominal to the lumbar incision. Sand pillow was now placed under lumbar spine; palpation showed no abscess of liver, no opening in diaphragm (as from empyema), no signs of psoas abscess, or caries of spine. Further search along cystic duct, duodenum, and stomach showed no perforation. Finger passed through adhesions around foramen of Winslow showed no pus or gastric contents in lesser peritoneal cavity. Right flank and gall-bladder region remained dry. Gauze drain placed to neck of gall-bladder. The appendix was found on outer side of cæcum, pointing up to flank; it felt very hard and thick. It was acutely flexed on itself about its middle, and its distal half was gangrenous and perforated. Its base was delivered, ligated, divided, and carbolized, but not buried in cæcum; meso-appendix then ligated, and appendix removed. The raw surface left on the ascending colon, between the wide-spread layers of divided meso-appendix, was partly covered in by sutures. Omentum was scanty and *very slimy*. Glass tube showed the pelvis full of pus. Pelvis was drained by glass tube through suprapubic stab wound. Main incision in right rectus (about six inches) closed in layers except at middle, where drains emerged. Time, one hour. Condition good at end of operation.

Head of bed raised, and continuous proctoclysis ordered. December 29: temperature 98.8° F. Abdomen not rigid. No vomiting. A little tearing pain now and then. December 30: temperature 99° F. Doing well. December 31: temperature rose to 101° at 8 P.M. No abdominal symptoms. January 1: temperature 105° F., patient dying. Glass tube replaced by rubber, and new gauze wick inserted beneath liver. No cause found for symptoms. Death at 2 P.M., nearly four days after operation.

Exploration of wound after death showed no pus in upper right quadrant. Lymph and adhesions beneath transverse mesocolon to left of origin of jejunum, showing the peritonitis to have been very wide-spread at one time. Most of jejunum and ileum were entirely normal. Stump of appendix in good condition. No

perforation of stomach or duodenum; gall-bladder normal. Lesser peritoneal cavity shut off by adhesions and not affected. Drainage tube to pouch of Douglas had drained it perfectly dry; there was no pus at all in the pelvis, but a loop of lower ileum was adherent to uterus and bladder, and an abscess containing several ounces of pus had formed between these *in front of uterus*. This was a space which had not been drained. Death evidently occurred from a terminal infection arising in this abscess.

The attack evidently started as an acute appendicitis, pus forming in right flank and pelvis, and extending from right flank to subphrenic region, and from pelvis to left flank and general peritoneal cavity.

II. APPENDICITIS FOLLOWED AFTER SIX MONTHS BY SUBPHRENIC ABSCESS.

Orion L., age 17 years, was admitted to Dr. Davis's service in the Episcopal Hospital March 23, 1908, with a history of being ill for three days with appendicitis. Had a similar attack one year ago. When admitted he had a temperature of 103° F., and a pulse of 128. Abdomen was rigid in right iliac and suprapubic regions, and extremely tender in both places. Not tender in either flank. No mass, no dulness.

Operation, 9.20 P.M. (on third day of illness). Transverse incision (G. G. Davis: *Trans. Phila. Acad. Surg.*, 1906, viii, 160), two inches; on opening peritoneum free pus was found, with no adhesions. Appendix delivered. It was short, sub-cæcal, much twisted on itself, perforated at its tip, and there was a concretion loose in the abdominal cavity. Appendix removed, stump ligated, and buried in cæcum. Cæcum friable and spotted with lymph. Omentum not seen; glass tube and gauze drain to pelvis. Another gauze strip to right flank, as there was pus here also. In all, seven or eight ounces of pus were evacuated. No record of culture. Inner half of wound closed in layers. Time of operation, 20 minutes.

The appendix was gangrenous, and contained, in addition to the concretion which had escaped from the perforation at its tip, also another concretion, with a stricture each side of its bed; the thickness of the walls of appendix gave evidence of the former attack. Patient kept sitting up in bed, and given

continuous enteroclysis. Subsequent wound healing uneventful.

April 2 and 3: slight fecal discharge from wound. April 22: up in wheel chair. On May 2, was discharged; wound firm, only superficial granulating area.

Sept. 26, 1908, he was re-admitted to Dr. Deaver's service, Episcopal Hospital, complaining of pain in abdomen and right side. In July (two months after discharge) began to have pain in back, especially over eleventh right rib, in posterior axillary line. Pain was considered rheumatic. It has continued to the present. Liniments and belladonna plasters were tried but without effect. Two weeks ago began to feel worse, and confined to bed for last week; several sweats at night, and one chill. Pain in back increased and began to affect abdomen. Was treated for malaria.

He was emaciated, sallow looking; temperature 104.2° F.; pulse 112; respiration 26. A bulging, tender area over lower right ribs, in posterior axillary line. Scar of appendix operation firm, no hernia.

Operation, Sept. 26, 1908, Dr. Deaver: Incision in tenth intercostal space opened into abscess extending between liver and diaphragm, and along thoracic and abdominal walls down to cæcal region. Drain: two rubber tubes, one to cæcum, one between liver and diaphragm. Culture of pus negative. October 2: tubes removed. October 8: temperature normal. October 10: in wheel chair. October 19: discharged.

III. APPENDICITIS COMPLICATED BY VOLVULUS OF SMALL INTESTINE.

Beatrice T., age 13 years, was admitted to Dr. Frazier's service in the Episcopal Hospital, Dec. 22, 1907, with a history of an attack of acute appendicitis of one week's duration. On admission she presented a peritonitic facies, sweet smell to breath. Fecal vomiting. Has passed mucus, but no blood by rectum. Temperature 98° F.; pulse 128; white blood-cells 12,400. Abdomen is very much distended, tympanitic everywhere except in right iliac fossa and right flank, where note is dull; no change in level of dulness on change of position of patient. Too much distention to feel any mass. Not rigid, not very tender. By rectum finger feels hard and very tender mass in Douglas's pouch. Lungs negative; slight systolic murmur at apex of heart.

Operation, 3.40 P.M. (one week after onset of illness). Etherized while abdomen was being prepared. Percussion of hypogastric region now gave *succussion splash*, i.e., fluid in air-containing cavity. Incision through right rectus close to median line: omentum presented, adherent to mass of intestine; omentum was full of distended veins, dark yellow and dull. Gauze packs placed. Appendix when delivered was found gangrenous and perforated about one inch from base. Stump ligated, divided, and carbolized, but not buried in cæcum. Glass tube to pelvis gave about one ounce of bloody seropus. Felt many obstructing bands, and found gangrenous small intestine; delivered this, and found a clockwise volvulus of ileum, which was untwisted by giving it one and a half turns in a counter-clockwise direction. This was the gut that was full of fluid and air and that gave succussion splash; it occupied the pelvis, and was the tender mass felt by rectum. The small intestine which occupied the right flank, outside of ascending colon, was also dark blue, distended, and sloughing in spots. Eventration of affected small intestine, with constant hot saline irrigation; this resulted in some improvement in color of highest loops of ileum. Next found collapsed bowel, and traced it up to lower end of distended portion, clamped and divided it, and resected four and a half feet of gangrenous ileum. To relieve distention above region resected, a glass tube was passed up lumen of bowel, as recommended by Monks, emptying upper coils of jejunum of gas and fæces, and thus rendering easier their return to abdomen. Then sutured the divided ends of gut to each other and end on into the wound, making a false anus *en canon de fusil*. Time, 1 hour and 15 minutes.

Patient died about half an hour after return to bed.

IV. APPENDICITIS FOLLOWED BY VOLVULUS OF SMALL INTESTINE.

Frank G., age 16 years, was admitted to Dr. Frazier's service in the Episcopal Hospital, Dec. 7, 1909, with a history of acute attack of appendicitis of over two days' duration. On admission his temperature was 100° F.; pulse 110; white blood-cells 11,600, with 77 per cent. polynuclears. Abdomen showed small mass close to anterior superior spine of ileum, the rest of abdomen being soft.

Operation at noon (56 hours after onset of attack). Trans-

verse incision of G. G. Davis, three inches long, opening healthy peritoneum on median side of mass. Gauze pads introduced. Light adhesions around cæcum, and gangrenous appendix lying posterior to cæcum; no actual pus. Appendix gangrenous, and had a small perforation on its mesenteric border. Meso-appendix ligated with chromic catgut and divided. In attempting to deliver appendix, it pulled off cæcum, owing to gangrenous state. Stump of appendix at once clamped (no extravasation of fæces), ligated, and buried in cæcum; one bleeding point near ileocæcal valve controlled by separate suture. Cæcum had flakes of lymph on it. Glass tube was passed to pelvis, and a few drachms of thin pus were withdrawn. Culture of pus reported "numerous bacteria, *mixed*." Drains: glass tube to pelvis, one strip of gauze to stump of appendix, and one to hold small intestine away from incision, inner half of which was closed. Time of operation, 30 minutes.

Patient kept sitting up in bed, and given continuous proctoclysis.

December 8: temperature normal; pulse 100. Given some water early this A.M.; vomited at 8 A.M., after some abdominal pain. Abdomen a little distended in epigastrium. Two ounces of pus from glass tube.

December 9: vomited again. Occasional sharp pains. Rubber tube inserted in place of glass. Epigastrium more distended; no flatus by rectum. Temperature normal; pulse 96-110. Two enemas in evening gave fair bowel motion, very little flatus. *No peristalsis can be heard*. Diagnosis: paralytic ileus. Ordered eserine, grain one-sixtieth, at 3 and at 6 P.M. Gastric lavage relieved distention.

December 10: vomited again, bile only. Examined by Dr. Neilson, who concurred in diagnosis of paralytic ileus, and who advised salts in lavage fluid. No flatus was passed. Soon after this examination, peristalsis could be heard, and just after giving next lavage patient vomited some upper intestinal contents. Examined by Dr. Deaver, who diagnosed mechanical obstruction and advised operation. White blood-cells 29,600, with 86 per cent. polynuclears.

Second operation, 5.30 P.M. (53 hours after first operation). Ether. Reopened transverse incision; pus between skin and sheath of rectus, edges of drained portion of wound were green; all parietal peritoneum of iliac fossa was gray-green; tube

draining pelvis well. Lower ileum collapsed. No cause for obstruction found here. Median incision, from left of umbilicus to pubes; no diffuse peritonitis; upper and left abdomen full of distended coils of small intestine; nothing else seen. Delivered six to eight feet of distended gut, and could then see collapsed ileum; picked it up, determined its direction, and traced it upward. Found that loops of distended gut had twisted around this collapsed gut in a contra-clockwise volvulus. Reduced this volvulus by one full turn in clockwise direction. Tracing collapsed gut higher, found three distinct kinks in loops of ileum lying in pelvis, the adjacent limbs held tightly together, and entirely occluding lumen. Almost gangrenous in spots. Kinks separated, and rent in mesentery sutured. Constant hot irrigation over eventrated bowel. Iodoform gauze wick placed over sloughing area; intestines replaced in abdomen; large rubber tube to drain pelvis; wound closed with through-and-through sutures. Time of operation, 45 minutes.

During operation received one pint and a half of saline solution intravenously; was very badly shocked. Stomach washed out again at end of operation. Returned to bed in exceedingly restless condition, and died 26 hours later, on the fifth day after first operation.

Dr. Ashhurst added that cases such as these represent a fair proportion of the emergency work of a large hospital. Although only one of the patients recovered, a discussion of certain of the features of the fatal cases might prove of interest.

Cases of appendicitis may be grouped for clinical purposes thus: 1. Uncomplicated appendicitis, either acute or in the interval. 2. Appendicitis with abscess. 3. Gangrenous appendicitis. 4. Appendicitis with diffuse peritonitis (no adhesions). 5. Appendicitis with multiple abscesses (numerous adhesions). 6. Appendicitis with intestinal obstruction.

Almost invariably a patient when first seen will fall quite unmistakably into one or other of these groups. The first group is the least serious, and the mortality is less than 1 per cent. The other groups represent cases progressively worse, and the mortality under any kind of treatment rises by leaps and bounds. These groups are not mentioned in pathological sequence, but in the order of their clinical gravity. Many cases of appendicular abscess have passed through the stage of diffuse peritonitis, operation having been delayed purposely or through ignorance.

But not all cases of diffuse peritonitis are converted into the less serious class of appendicitis with abscess; a large proportion of them pass over into the form of peritonitis with multiple abscesses, and from this, or without passing through the intermediate fifth group, they become complicated by intestinal obstruction. It is on account of this uncertainty as to the course which cases of diffuse peritonitis are going to pursue, that Dr. Ashhurst does not favor the treatment advocated by Ochsner, of treating all such patients by gastro-intestinal rest and postponing operation until an abscess forms; because in a number of cases no localized collection of pus will occur at any time, but either multiple abscesses will develop or intestinal obstruction will occur, or the patient will die of septicæmia or a terminal infection before relief is afforded by operation.

The first case reported belongs to the fifth group, that of appendicitis with multiple abscesses, the patient having had, in addition to the subphrenic abscess, pus widely diffused in her abdomen, including the pelvis, both flanks, and the region beneath the transverse colon, as shown at autopsy. The second case, with volvulus which occurred before operation was undertaken, belongs to the sixth group. Both these patients could almost certainly have been saved if operation had been possible at an earlier stage of the disease. It is very much more usual for subphrenic abscess or intestinal obstruction to arise some time after an operation than for operation to be postponed until they are present; and when occurring after operation the prognosis usually is much better.

Probably the most complete statistics of subphrenic abscess are those of Lance (*Gaz. d. Hôp.*, 1909, lxxxii, 63, 99), who collected almost a thousand cases, analysis of which confirms the figures published by others, showing that about 20 per cent. are caused by appendicitis; 30 per cent. are caused by lesions of stomach and duodenum; 13 per cent. are caused by lesions of liver and gall-bladder; 37 per cent. are caused by lesions of pancreas, spleen, large intestine, pleura, etc.

In regard to subphrenic abscess caused by appendicitis, Lance estimates that it occurs in 0.5 per cent. of cases of appendicitis of all kinds, and in 3 per cent. of cases of suppurative appendicitis. In about two-thirds of the cases it occurred some time after operation, usually in cases of appendicitis with localized abscess. He found only 10 cases recorded in which the sub-

phrenic abscess was a primary development in connection with general peritonitis (as in the first case recorded herewith); and in most of these cases no operation was done, the condition being discovered only at autopsy. Lance found that empyema exists in about 60 per cent. of post-appendicular cases of right-sided subphrenic abscess.

Nearly all cases of subphrenic abscess which follow appendicitis are right-sided. Among 106 cases studied by Eisendrath (*Jour. Amer. Med. Assoc.*, 1908, i, 751), only six were left-sided abscesses; and in the large majority of cases the infection spreads by continuity, invading first the right renal pouch, then the right posterior intraperitoneal subphrenic space, including the subhepatic space, and finally reaching the right anterior subphrenic space around the free margin of the right lateral ligament of the liver.

As pointed out in Barnard's admirable lectures (*Brit. Med. Jour.*, 1908, i, 371, 429), the diagnosis is based on the *history of the case, the character of the onset, the signs of pus in general, abdominal signs and symptoms, thoracic signs and symptoms, localizing signs*, and, as a last resort, *aspiration*. In the first case reported it does not seem likely that a more accurate diagnosis was possible than was made: there was undoubtedly diffuse peritonitis, and with a history of indigestion, and most marked symptoms pointing to the upper right quadrant, the gall-bladder or upper digestive tract appeared more likely to be the cause of the trouble than the appendix. In the second case, however, not only was there the previous history of an operation for appendicitis with diffuse peritonitis, but there were very positive localizing signs (bulging, tenderness), which rendered diagnosis easy.

The treatment naturally consists in the evacuation of the abscess; and the incision may be anterior, posterior, or lateral. Lateral incisions are seldom advisable, being suitable only where the abscess is manifestly pointing in the axillary line. Anterior or abdominal incisions are employed in cases of exploration, where the diagnosis is uncertain, and are to be preferred in all cases complicated by diffuse peritonitis, as in the first case recorded herewith. It usually is advisable to make a counter-incision in the loin, for drainage. In the great majority of cases of subphrenic abscess, however, which conform rather to

the type of Case II, where the abscess is of slow formation, and where a positive diagnosis is made before operation, the posterior transpleural or subpleural route is preferable.

Volvulus appears to be more frequent in the small than in the large intestine, contrary to the classical teaching; at least in his own experience, which includes four cases of *volvulus* (two in connection with a Meckel's diverticulum, and the two just reported), there has not been one case in which the colon was affected. At the March meeting of the Academy, Dr. Hodge (*ANNALS OF SURGERY*, 1910, ii, 271) presented statistics as to the frequency of *volvulus*, reporting 1 case of *volvulus* among 61 cases of intestinal obstruction at the Presbyterian Hospital during the last decade, and 7 cases among 57 operations for intestinal obstruction at the Pennsylvania Hospital. Dr. Ashhurst's own experience with intestinal obstruction (apart from strangulated hernias and congenital deformities) embraces only 10 operations, yet 4 of these were caused by *volvulus* (Case IV, recorded herewith, also presented kinks).

Volvulus seems to be a rare complication of appendicitis, especially when arising before operation. Le Conte reported (*ANNALS OF SURG.*, 1905, i, 148) a case of *volvulus* of the small intestine occurring two months after appendectomy, which he successfully treated by operation four days after the first symptoms, which commenced mildly; but as there was no mesenteric thrombosis in the affected bowel, he thought the *volvulus* could not have arisen more than a few hours before operation. When the bowel is gangrenous, as in Case III of the present series, there is nothing to do but resect it; and if the portion removed is high in the intestinal tract, and the patient's condition warrants it, an end-to-end anastomosis should be done; but in cases, as in the present instance, where it is necessary to terminate the operation rapidly, it is better to establish a false anus.

In Case IV, an earlier diagnosis might have enabled the patient's life to be saved. But the differential diagnosis between mechanical and paralytic ileus, while easy in theory, is not always so in practice; and in the absence of projectile vomiting, with no evidence of peristalsis, and with a minimal amount of pain, the existence of mechanical obstruction was not determined until the third day after operation, when pain, peristalsis, and projectile vomiting became noticeable features of the

case. Yet on opening the abdomen it was clear that obstruction must have been complete for 24 hours at least.

The *technic of the operation for intestinal obstruction* is one of the least regular and typical known to surgery, and this is perhaps one reason why so few patients are saved by it. It is an accepted fact that it is undesirable to eventrate the distended bowels, and that the collapsed bowel should be sought and traced upward. To find the collapsed bowel it is recommended first to locate the cæcum or transverse colon; if these are distended, the obstruction must be still lower. But in a great many cases, as in Case IV, the distention of the bowels is so great that it is perfectly impossible to see anything else, or even to introduce the hand for search, until the distended coils are removed from the abdomen. But as soon as they are relieved from the pressure of the abdominal wall they become still more distended, and the difficulty of their replacement momentarily increases. Moreover, if we are to believe the physiological researches of Henderson, the acapnia induced by means of these distended bowels greatly increases the shock. In Case III, the use of a glass tube passed up the lumen of the bowel toward the duodenum, as recommended by Monks, quickly relieved the distention and considerably facilitated the return of the intestinal coils to the abdomen. It was not found possible, however, to crowd more than about two feet of intestine upon the tube at one time; but this was sufficient for the purpose in this case. It has been suggested by C. A. Morton (*Brit. Med. Jour.*, March 13, 1909) that the coils of small intestine are not paralyzed by distention so easily as they are thought to be; he holds that kinking prevents the various loops from emptying themselves into one another, and contends that if kinks were absent a single opening in the small gut would be as efficient in emptying it throughout its entire extent as is a single opening in the colon in relieving distention of the entire large bowel. But the difficulty of overcoming the kinks remains, and several attempts with Monks's glass tube method have not enabled the speaker to overcome the difficulty entirely; the most that it has done has been to promote euthanasia.

Finally Dr. Ashhurst said he should like to secure an expression of opinion from the Fellows of the Academy as to the value of eserine in paralytic ileus. There has sometimes been a suspicion in his mind that its employment has produced mechan-

ical obstruction, by rousing violent peristalsis; and he paraphrased a saying of his father's, that the patient is not sick because his abdomen is distended, but his abdomen is distended because he is sick.

DR. JOHN H. GIBBON, in regard to Dr. Ashhurst's question relative to the use of eserin, said that if there is a mechanical obstruction in the bowel it will do harm, because it is like giving a laxative or purgative to stimulate peristalsis in a strangulated hernia. If one could only say which cases were and which were not mechanically obstructed one could better gauge the use of eserin. Personally, he thought that most of the obstructions after operation are due to some mechanical cause, and in them, therefore, eserin, or anything of a like nature, is apt to do more harm than good.

DR. JOHN H. JOPSON said that he reported last spring before the Academy three cases of subphrenic abscess following appendicitis out of seven or eight subphrenic infections which he had had in his own practice.

With regard to the case reported in which the subphrenic infection was present at the time of operation, he thought it a very unusual one, in that the case was operated upon when the infection had reached the abscess stage. In these cases which are now subjected to the Murphy treatment, it would seem that subphrenic abscess occurs more frequently than formerly, although he did not mean to say that this was due to the Murphy-Fowler position. Formerly they died of peritonitis before it had time to develop. These abscesses are oftentimes overlooked and cases dying with high temperatures and with collections of pus under the diaphragm are often looked upon as cases of peritonitis elsewhere.

With regard to the location of the appendix in these cases, in two of his cases it was retrocæcal and very high, and in one of these cases he made a counter-opening in the back in order to avoid a subphrenic infection, but unsuccessfully.

As a point in diagnosis, the presence of symptoms of pulmonary infection, subcrepitant râles, and diaphragmatic pleurisy is of great value in making the diagnosis in the early stage. The presence of râles as a frequent symptom was doubted by Barnard in his classical paper, but it is an important diagnostic symptom.

DR. GEORGE P. MULLER, with regard to the use of eserin

in intestinal ileus, remarked that he had had brilliant results in a few cases with it. These were, of course, cases of adynamic ileus, generally due to extensive handling of the intestines, especially in placing gauze pads for pelvic operations. He usually tried eserin in any case of intestinal obstruction where he was not sure that it was mechanical in origin. He uses large doses and gives in addition the alum enema as recommended by Dr. Murphy. He did not wish to be understood as advocating delay in the surgical treatment of cases of intestinal obstruction, but wished to state that his experience with eserin in suspected cases of paralytic ileus had been on the whole extremely satisfactory. The advantage of giving eserin at hourly intervals for three or four doses lies in the fact that, unlike medicinal purgatives, it does not increase the fluid content of the intestines but acts by stimulating the muscle of the bowel.

DR. MORRIS BOOTH MILLER said, with regard to the use of eserin, that he agreed with Dr. Gibbon that disappointment often attends its use. He had, however, used it routinely for several years in every case where he feared post-operative ileus. He employed it as a precautionary measure, and so far had been so fortunate as not to have this post-operative complication occur. He used it, alternating it with strychnia, and thereby getting more powerful stimulation to the involuntary muscle of the intestine. With this combination one seems less apt to get the poisonous effect of the eserin.

DR. ROBERT G. LECONTE said, with regard to the use of eserin, he agreed with Dr. Muller. He used it frequently in cases that develop distention after abdominal operation, with the belief that if it does no good it at least can do no harm, and it may perhaps permit of a diagnosis of obstruction due to mechanical causes to be made sooner than without its use. If it is not effective, it will make the vomiting more obstinate, which may lead to operation the sooner. As Dr. Muller says, it does not increase the contents of the intestines and in that it has marked advantages over the purgatives.

DR. ASTLEY P. C. ASHHURST, in closing, said he was not partial to the use of eserin. In the case reported it had seemed to rouse so much peristalsis as to cause obstruction. In another case, after operation for typhoid perforation, the abdomen was immensely distended, eserin was given; the man had another perforation, and died.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

*Stated Meeting, held at the Presbyterian Hospital,
October 26, 1910.*

The President, DR. ELLSWORTH ELIOT, JR., in the Chair.

DECORTICATION FOR POLYCYSTIC KIDNEY.

DR. ELIOT presented a woman, 28 years old, who was admitted to the Presbyterian Hospital in June, 1910. The history she gave was that about six years ago she accidentally discovered a lump in the right flank; this had gradually increased in size, and had given rise to a dull, aching pain.

Examination showed a large mass in the right flank, which was evidently connected with the right kidney. The patient was catheterized by Dr. Alfred T. Osgood, who reported that the urine from both ureters was of the same character; it was of a low specific gravity, containing a small amount of urea; no albumin nor casts, no tubercle bacilli.

A diagnosis of polycystic kidney was made, and this was verified upon exposure of the right kidney. Decortication of the kidney was done, and the wound closed. At the time of this operation, which was done about five months ago, there was no perceptible enlargement of the opposite kidney, but since then this kidney had increased in size; it was now freely palpable and evidently undergoing a similar cystic degeneration as had already taken place on the right side. There had been no change in the character of the urines from the two sides.

TRANSFUSION FOR EXTREME ANÆMIA IN AN ADULT.

DR. ELIOT presented a man, 54 years old, a commercial traveller, who was admitted to the hospital on April 12, 1910, with the diagnosis of progressive pernicious anæmia. His family history was negative, and there was nothing in his personal history that had any bearing upon his present illness. He stated that for two years he had suffered from nervousness, loss of appetite, and weakness, with intermittent attacks of jaundice. For the previous four months there had been œdema, spreading

from the ankles to the legs, thighs, genitals, hands, and face. There was frequent urination. He had been confined to bed for seven weeks, and for one week had vomited blood daily. He was very short of breath.

Upon admission to the hospital the patient was cachectic, emaciated, nervous, and depressed, and the skin everywhere showed evidence of jaundice. There was a systolic and pre-systolic murmur at the base of the heart. The abdomen was full, tense, and more prominent on the right side. The spleen was enlarged and palpable. The urine contained a trace of albumin and indican, with hyaline and granular casts. A blood test showed 800,600 red blood-cells, with 25 per cent. of hæmoglobin, the blood picture being typical of pernicious anæmia. The stools contained no ova nor parasites.

During the patient's first twelve days in the hospital he gradually grew worse. He became more dyspnoic and nauseated, and had a corpse-like appearance. Transfusion was done on April 25. At this time his condition was such that he was entirely unconscious of the operation, and for three days afterward he had no recollection of events that were transpiring. From that time on he began to improve very rapidly. His dyspnoea and nausea disappeared, his heart action improved, and his color became practically normal. An examination of the blood, made on April 30, five days after transfusion, showed 60 per cent of hæmoglobin, with 3,032,000 red blood-cells. On May 31 the hæmoglobin had increased to 85 per cent., and the red blood-cells numbered 4,296,000.

When the patient left the hospital on June 1 he was apparently cured. He went to the Delaware Water Gap, where for a month his improvement continued. Then he began to lose appetite and strength, and again became jaundiced. When he returned to the hospital on October 23, he was again very anæmic, and a blood test showed 40 per cent. of hæmoglobin and 1,210,000 red cells. Dr. Eliot said that a second transfusion would probably be made, but he doubted whether it would be of any permanent value.

TRANSFUSION FOR PERNICIOUS ANÆMIA: TWO CASES.

DR. GEORGE WOOLSEY presented two patients. The first was a man, 54 years old. He was born in the United States, married, an artist and teacher by profession. He was admitted to the

Presbyterian Hospital on May 27, 1910, with the diagnosis of pernicious anæmia.

The patient's present illness dated back three years, when he began to suffer from dyspnœa, vertigo, cough, and occasional epistaxis. There were numbness and œdema of the extremities, with increased frequency of urination. Two years ago he was an inmate of the hospital for some time, and since his discharge he has never been strong, and is easily exhausted. For the past year his ankles have been swollen, with the formation of ulcers over the tibia.

Upon admission to the hospital the patient was very pale, but not emaciated. He appeared weak and dyspnœic, but not cyanotic. The heart was slightly enlarged to the left; the heart sounds were faint but regular, with a systolic murmur at the apex. A blood test showed 14 per cent. of hæmoglobin, with 924,000 red cells and 6,000 white cells. On September 22 a blood test gave about the same results, the picture being typical of pernicious anæmia. At this time an attempt was made at transfusion by the vein-to-vein method, but this had to be abandoned, as the blood-pressure in the patient's vein, which spurted on the proximal side, was higher than that in the donor's. This would have caused the blood to flow in the wrong direction, and the donor would have received the transfusion instead of the patient.

On September 27 another donor was secured, whose blood was tested for hæmolysis and agglutination with that of the patient, and a successful artery-to-vein transfusion was done. Immediately following this the patient's color improved greatly and the hæmoglobin rose to 30 per cent., but late that night he had a chill, followed by a temperature of 104.6°, and he became irrational. An examination of his blood showed the presence of very numerous malarial plasmodiæ, and they were also subsequently found in the blood of the donor, although he had never before given any symptoms of malaria. Dr. Woolsey said this was at least one example of the transmission of malaria where the mosquito did not act as the host.

The patient's malaria symptoms disappeared under the administration of quinine, and at present his general condition is improved, but he is very little better than before the transfusion. His blood at present shows 30 per cent. of hæmoglobin, with 3,172,000 red blood-cells, but is still typical of pernicious anæmia.

Dr. Woolsey's second case of pernicious anæmia in which transfusion had been done was a woman, 35 years old, a laundress. She was a native of the United States, married, and was admitted to the hospital on September 21, 1910. Her family history was negative; the patient herself had been nervous and moderately alcoholic, and had never enjoyed robust health. Her menstruation had been irregular, and the flow insufficient.

Her present illness began about a year ago with indigestion, weakness, and vomiting. There was some swelling of the legs, but no symptoms of cardiac trouble. There was increasing pallor; her menstrual periods became very brief, with scanty flow. When the patient was admitted to the hospital she had a death-like pallor, but she was not emaciated and there was no dyspnœa. She was more or less irrational. The heart sounds were faint, and there was a soft, blowing, systolic murmur at the apex and a diastolic murmur in the pulmonic area. The spleen was not enlarged. A blood count showed 13 per cent. of hæmoglobin, 710,000 red cells, and 3200 white cells, with 18 per cent. of polymorphonuclears and 74 per cent. of lymphocytes, the blood picture being characteristic of pernicious anæmia. The urine showed a faint trace of albumin; the fæces contained no ova nor parasites.

After discharging two or three would-be donors whose blood hæmolyzed or agglutinated that of the patient, a satisfactory donor was found, and as the patient was evidently losing ground, she was transfused on September 29, 1910. Following this there was an immediate improvement, both in her color and mentality. A blood test at the end of the transfusion showed 45 per cent. of hæmoglobin. On October 4 this had increased to 62 per cent., with 3,630,000 red cells, 7300 white cells, polymorphonuclears 92 per cent., and lymphocytes 6.3 per cent.

Since the transfusion in this case, Dr. Woolsey said, the improvement in the patient's condition had steadily progressed. Her color was now good, and the last blood test, made on October 17, showed 59 per cent. of hæmoglobin and 2,976,000 red cells, which were normal, showing no appearance of pernicious anæmia. She sits up in a chair and walks a few steps.

In both cases a few ounces of blood were allowed to flow from patient's vein before the transfusion was started.

It has been stated by Crile and others that transfusion is

contraindicated in pernicious anæmia, but the clinical evidence of this assertion is neither great nor sufficient. These two cases are too recent to indicate any permanent result, and it remains to be seen how long the improvement lasts. But even if temporary improvement, as great as in the last patient shown, can be obtained, the transfusion is worth while.

DR. CHARLES H. PECK said that the result of the transfusion in the second case shown by Dr. Woolsey was remarkably good, in view of the fact that the case was apparently one of true pernicious anæmia. In view of the evidence that the condition of the woman's blood was steadily improving, a permanence of the cure might be hoped for.

EXSTROPHY OF THE BLADDER.

DR. WOOLSEY presented a boy, three years old, who was admitted to Bellevue Hospital on April 19, 1910. He was born at full term with an exstrophy of the bladder, for which he had been operated on three times by the family physician, but his condition had remained practically unchanged.

At the time of his admission to the hospital, the boy was fairly well nourished. In the suprapubic region there was a bulging, red, moist surface, about an inch and a half in diameter, extremely tender and bleeding readily. It was surrounded by scar tissue, and continuous with its lower margin could be seen the urethral groove continued on the dorsal surface of a rudimentary penis. The ureteral openings on the mucous surface emitted urine periodically. The symphysis was open.

On April 21, 1910, Dr. Woolsey made a median incision, two and a half inches long, encircling the exstrophy below and carried through the peritoneum above. After inserting a probe into both ureters, the ureteral orifices with the surrounding and connecting mucosa of the trigone were dissected free from the rest of the mucosa of the bladder. The ureters were dissected free for about two inches. Calculi were detected in both ureters; they were thereupon incised longitudinally, and two large calculi were removed from the right ureter and five from the left. These calculi were faceted by contact with one another. The wounds in the ureters were then sutured with fine catgut. The upper sigmoid was then clamped off, and the isolated area of bladder mucosa containing the ureteral openings was sutured into an inch and a half longitudinal incision along the free

margin of this part of the sigmoid. These sutures of fine catgut were then reinforced by a row of fine silk sutures. The rest of the bladder mucosa was removed. The wound was closed in layers, and a rubber tube drain inserted at its lower angle.

The patient bore the operation well, although slight stimulation was necessary. The convalescence was complicated by the ureterotomy which accounted for a leakage of urine, at first slight and then considerable. After about ten days a fecal fistula developed. This finally closed, and then later the urine ceased to flow and was passed per rectum, rendering the movements watery.

When the patient left the hospital, on June 1, 1910, he was well with the exception of a slight, depressed, granulating area at the site of the drainage, and the fistula. This still persisted, and would necessitate a slight secondary operation. He is now able to hold his urine about two to three hours, and is continent. His general condition is much better than before.

CYSTADENOMA OF THE OVARY.

DR. WOOLSEY presented a single woman, 46 years old, a music teacher, who was admitted to the Presbyterian Hospital on September 27, 1910. The patient stated that she had enjoyed good health up to three months ago, when she began to complain of a sharp, steady pain on both sides of the abdomen, which was worse on walking or standing and which sometimes radiated into the back. It also radiated directly across the abdomen, never downward. At the same time the abdomen began to swell, especially during the past two months. The enlargement was bilateral and symmetrical. She also complained of paræsthesia of the right thigh, followed by partial anæsthesia. There was considerable emaciation and a cough, with scanty mucous expectoration. No vomiting, no diarrhoea, no urinary disturbances. There was chronic constipation. Menstruation had been absent for the past four months.

Upon examination, the abdomen was found much distended, and a fluctuating mass was felt extending from the symphysis to two inches below the free border of the ribs. It was dull on percussion, soft and slightly tender. There was shifting dulness in the flanks.

Operation.—Upon incision, a yellowish, gelatinous substance,

loosely adherent to everything in the peritoneal cavity, filled the abdomen. A mass about eight inches in diameter lay in the pelvis. This was found to be composed of multiple cysts containing similar gelatinous material, and some of these cysts had ruptured, allowing their contents to escape. The mass was attached to the ovarian end of the left broad ligament. The uterus was normal. The right tube and ovary were absent, having been removed at an operation for abdominal cyst twelve years before. The left tube was normal, and the left ovary was altogether cystic. There were small gelatinous nodules on the small intestine, and on the large intestine small black papillæ-like masses, presenting the appearance of malignant peritoneal involvement.

The operation done by Dr. Woolsey consisted of removing the gelatinous material from the abdominal cavity as far as possible, and taking out the uterus and left tube and cyst. The wound was sewed up without drainage. The patient made an excellent recovery and left the hospital on the sixteenth day after operation with an apparently normal abdomen. Pathological report, cystadenoma of the ovary. The striking feature about the case was the enormous amount (many quarts) of free gelatinous material in the peritoneal cavity. This seemed to dissolve freely in hot salt solution. In spite of the generally benign nature of ovarian cystadenoma, recurrence is to be looked for here.

URETERAL CALCULUS.

DR. WOOLSEY presented a man, 33 years old, a letter carrier, who was admitted to the Presbyterian Hospital on September 14, 1910, and whose present illness began six days before with cramp-like pains in the right side, radiating to the back. He had vomited once. There had been no attacks of jaundice. Urination had lately become difficult. There was a similar attack of pain each night since the onset. The patient stated that he had had a similar attack four years ago.

Upon examination, there was marked tenderness over Murphy's point. The gall-bladder was not palpable. There was also marked tenderness in the right flank. There was marked pain on striking the costovertebral angle sharply. The urine contained a faint trace of albumin. The symptoms left one in doubt as to whether there was a gall-bladder or renal condition, and in this consisted the interest in the case. An X-ray

showed a faint, indistinct shadow opposite the third lumbar spine. Hence upon operation a two and a half inch incision was made, splitting the upper right rectus. The gall-bladder was found to be normal, but a calculus was located by palpation, opposite the lower pole of the right kidney. The peritoneum was then closed, and the patient turned on his left side. A nephrectomy incision was then made over the right kidney, and the stone in the ureter fixed and raised near the surface by a strand of catgut passed around the ureter above and below it. The ureter was then opened and the stone removed. After a flexible searcher was passed through the ureter in both directions to prove its patency, the ureteral incision was closed with three plain gut sutures. A small cigarette drain was inserted down toward the ureter, and the abdomen closed in the usual manner. The patient had a rather stormy convalescence; the abdomen was quite distended for the first few days, and there was considerable leakage from the ureter for 48 hours. This was followed by a slight purulent secretion which gradually subsided, and he was discharged, cured, on the nineteenth day. The distention of the abdomen was probably due to a paresis of the colon which sometimes follows operations in the kidney. The drain may have come in close contact with the ureter, which would have accounted for the leakage. The latter seldom occurs if neither suture nor drainage is used.

DR. OTTO G. T. KILLIANI said that in cases of ureteral calculus where the stone was located low down, it might easily be mistaken for a phlebolite. He recalled one case where the diagnosis of ureteral calculus was based largely upon the X-ray picture, but upon operation they found a primary carcinoma of the ureter with the formation of a phlebolite. Operation was abandoned.

DR. WILLY MEYER, speaking of Dr. Woolsey's procedure of fixing the stone by placing a ligature above it, said that he also had employed this technic to advantage, especially when the stone was low down, just above the entrance of the ureter into the bladder. He had put one catgut thread above and one below the stone, around the ureter, knotting them once only, of course without any undue tension. The method gave the operator good control of the ureter and assisted materially in the extraction of the calculus, as well as placing the sutures for closure.

DR. WOOLSEY, in reply to a question as to the indications for operation, said that he was not in favor of operating in all cases, especially when the stone was located low down and of small size. Under those conditions he would wait a certain length of time, as the stone might be expelled spontaneously. In other cases, however, where the calculus was of large size, as shown by the X-ray, where painful symptoms persisted, and especially where the urine showed indications of infection, he would advise operation.

DR. CHARLES A. ELSBERG said that in quite a number of cases of ureteral calculus of small size he had succeeded in expediting the passage of the stone spontaneously by introducing a catheter into the ureter to above the calculus and injecting oil.

SARCOMA OF THE OMENTUM AND MESENTERY.

DR. WOOLSEY presented a married woman, 45 years old, a native of Ireland, who had been an inmate of the Presbyterian Hospital on four different occasions. She was first admitted on November 2, 1908, complaining of a watery, irritating vaginal discharge, with some odor. Dr. Eliot did a supravaginal hysterectomy, removing the uterus and all its appendages excepting the right ovary.

She was readmitted on July 23, 1909, suffering from abdominal distention and weight, and upon examination a mass was felt in the abdomen. On August 12, 1909, Dr. Woolsey opened the abdomen, which contained considerable bloody fluid. A tumor, about the size of a grape-fruit, elastic and very friable, was found attached to the mesentery and gut. It apparently had no connection with the right ovary, which was about the size of a small egg. The tumor was easily peeled loose from its connections and removed. The right ovary was also removed. The pathologist at this time reported that the growth was a fibroma.

On February 28, 1910, the woman returned to the hospital for the third time. She stated that she had had no symptoms, but had accidentally discovered a tumor, about the size of her fist, in the region of the umbilicus. The abdomen was reopened by Dr. Eliot, who found a mass about six inches in diameter, with an irregular, nodular surface. It was attached to the ascending, descending, and transverse colon. It was removed, together with considerable adherent omentum. Th

colon was carefully cleansed of all suspicious particles; no metastases were found. At this time the pathological report was spindle-celled sarcoma.

The patient was readmitted to the hospital on July 19, 1910, with the history that four weeks prior to that time masses had been found in the abdomen on a routine examination. Four days prior to admission she had been attacked with cramp-like pains, abdominal tenderness and fever. On July 19, when Dr. Woolsey reopened the abdomen, he first encountered a number of adhesions of the gut to the old scar. To the right of these adhesions there was a large abscess filled with yellow, foul-smelling pus. Below this abscess was a tumor the size of a peach attached to the wall of the appendix, which was enlarged, thickened, and acutely inflamed. The wall of the intestine was studded with white plaques. The abscess was evacuated and the appendix and tumor removed. Following this operation, a fecal fistula developed, and there was a purulent discharge which persisted for some time, but this gradually ceased and the patient left the hospital on August 17 in apparently good health. The pathological report on the last specimen removed was spindle-celled sarcoma. The pressure of the tumor against the appendix appeared to be responsible for the appendicitis by interfering with its blood supply.

PERFORATING GASTRIC ULCER.

DR. CLARENCE A. MCWILLIAMS said he had had seven patients upon whom he had operated for perforations of the stomach or duodenum, and in four that he showed the operation had proven successful; the others had died. In the latter three, the operations were undertaken within six hours, twelve hours, and three days, respectively, after the perforations occurred. The man who had been sick three days was moribund at the time of the operation from general peritonitis; the other two were admittedly exceedingly alcoholic.

Of the four cases that recovered, the first was a man, 24 years old, who was admitted to the Presbyterian Hospital on April 25, 1907, being brought to the hospital at 12.30 A.M. by ambulance. The history obtained was that for six weeks he had been having some gastric distress after eating. There was no history of alcoholism in this case. Eight hours before operation he felt a sudden, severe pain in the epigastrium, spreading

over the entire abdomen. About an hour after the onset of the pain he vomited, and this was repeated twice before the operation, which was done at 2 A.M. His temperature on admission was 100°, pulse 88. A blood count showed 20,000 leucocytes and 88 per cent. of polynuclears. The entire abdomen was rigid. There was total absence of liver dulness, the tympany reaching as high up as the fourth space. The diagnosis was not absolutely certain, but a perforation of the stomach was considered possible, and an incision was made through the middle of the right rectus high up.

Upon opening the peritoneum, a turbid, greenish, mucoid fluid escaped; it was without odor, and contained whitish masses which were supposed to be curdled milk lumps. In none of the patients with perforations of the stomach upon which Dr. McWilliams had operated had he ever detected the slightest stomach odor in the abdominal fluid. In this case, litmus paper reaction to the abdominal fluid showed neutral. The finger inserted into the intact foramen of Winslow located the perforation on the anterior wall of the stomach, just internal to the pylorus. There were no adhesions about the perforation, but the edges surrounding it were indurated for about an inch. Purse-string silk sutures buried the opening, and over this a Lembert continuous stitch was passed. Continuous salt solution irrigation of the pelvis and the region under the liver and left flank was instituted, and two cigarette drains were passed into the pelvis and one under the liver. The patient made a perfect convalescence without incident, and is in excellent health at the present time.

The second case was that of a chauffeur, 30 years old, who, one day in March, 1910, at 4.30 in the afternoon, while driving his car in the Park was seized with such an excruciating pain in the epigastrium that he had to abandon his car and was brought to the hospital in an ambulance. At 5 P.M. his blood showed 21,500 leucocytes, with 76 per cent. of polynuclears. At 6 P.M. he refused to be operated upon. At 8 P.M. his blood showed 31,000 leucocytes with 90 per cent. of polynuclears, and his pain had become so severe that he asked for operation. Examination showed that his abdomen in its upper part was absolutely board-like, so that one could make no impression upon it. There was almost an entire absence of liver dulness.

The patient was operated on at 9 P.M. A small perforation

was found on the anterior surface of the pylorus, surrounded by an immense hardened area which was thought to impinge on the pylorus. For this reason, a two-row silk posterior gastro-enterostomy was added, using the Roosevelt clamp. The abdominal cavity was irrigated with Blake's tube and the abdominal wall closed without drainage. The patient made an uneventful convalescence. Since the operation, he has had some dyspepsia, being principally due to the accumulation of gas. No vomiting has occurred.

The third case shown by Dr. McWilliams was a man, 32 years old, who was operated on May 12, 1910, for a perforation of the stomach which had occurred eighteen to twenty hours previous to the operation. His temperature at the time was 100° F., pulse 80. A blood count showed 17,000 white cells and 90 per cent. of polynuclears. The diagnosis lay between a high gangrenous appendicitis and a perforation of the stomach or duodenum. The right abdomen was very rigid, with its point of maximum intensity in the upper rectus. The rigidity extended downward over the region of the appendix, and there was marked tenderness on rectal examination. An incision through the middle of the upper right rectus opened the peritoneal cavity, with the escape of an odorless, mucoid fluid. The perforation was only visible after the separation of some adhesions, and was situated on the stomach side of the pylorus. The area of induration was about the size of a silver half-dollar, with the perforation in its centre, large enough to admit the blunt end of a lead pencil. It was easily closed by interrupted Lembert sutures of black silk. The area of induration about the perforation was so great that it was deemed advisable to perform a posterior gastro-enterostomy, which was done, using the Roosevelt clamp and continuous chromic sutures in the mucous membrane, and continuous silk sutures in the serous coats. The right side of the abdomen and the pelvis were washed out with Blake's tube, and the wound in the abdomen was closed without drainage. The convalescence was without incident. Digestion has been perfect since the operation.

The fourth case concerned a man, 28 years of age, who had had an appendix operation eighteen months previously. On May 14, 1910, at nine o'clock in the morning, he was seized with severe abdominal pain, and at 2.30 P.M., when he was admitted to the hospital, his temperature was 102°, and a blood

count showed 31,000 leucocytes and 90 per cent. polynuclears. The right rectus was exceedingly rigid. There was no decrease in liver dulness. The patient was operated on within seven hours after the occurrence of the perforation. An incision was made through the middle of the upper right rectus, evacuating a slight amount of odorless, mucoid, brownish fluid. The wound was enlarged upwards, and with the finger some adhesions were separated under the liver, letting free a large amount of odorless, bile-stained fluid. There was an enormously indurated, thickened area on the stomach side of the pylorus, in the centre of which was a perforation about the size of the blunt end of a lead pencil. This was closed with two rows of continuous Lembert silk sutures. A posterior gastro-enterostomy was added as a safeguard in case the duodenum was constricted too severely. Two rows of continuous silk sutures were used, the jejunum not being rotated but being joined antiperistaltically to the stomach. The pelvis and right side of the abdomen were irrigated with normal salt solution through Blake's tube and the wound was closed without drainage. This patient developed a small abscess beneath the abdominal scar, into which it opened. His further convalescence was uninterrupted. Since the operation he has had considerable trouble with gas.

These four cases, Dr. McWilliams said, brought up certain questions for discussion: (1) the advisability of doing a gastro-enterostomy in suitable cases, namely, those in which the pylorus was thought to be constricted; (2) the use of salt solution irrigations; (3) the advisability of drainage.

DR. N. W. GREEN said in one case he found the perforation on the anterior surface of the stomach, and because of thickening, was unable to close it by inverting the edges of the opening. He therefore sewed the perforation to the abdominal wall, thus creating a gastric fistula. From experience in the Physiological Laboratory, he knew that a gastric fistula in a dog could not be kept open without the introduction of a spool. He expected a similar closure to take place in this case. The patient made a good recovery, and the fistula eventually closed. The speaker asked whether this would not be regarded as a rational procedure in cases where it was impossible to do an invagination.

DR. ARPAD G. GERSTER said the question raised by Dr. Green

was particularly interesting to him, as it recalled a case which was presented to this Society some years ago by Dr. Charles H. Peck, who had operated on the patient for a perforation of the stomach following ulcer. This patient had been operated on a year or two before that time by Dr. Gerster for the same affection. He came under the latter's care at the German Hospital with the history of sudden collapse, pointing to a perforation of some abdominal viscus. A tumor was made out in the epigastrium, and upon opening the abdomen an abscess was found, the contents of which indicated that it was associated with a previous gastric perforation. In that case, evidently, nature had done approximately what Dr. Green had suggested. The ulcer had healed at a time, when there was still a point of communication between the stomach and the abscess.

Dr. Gerster said he believed that under conditions, the suggestion made by Dr. Green, namely, to convert the perforation into a gastric fistula, might prove serviceable. If the leakage were checked, the fistula would heal in the course of time.

DR. BENJAMIN T. TILTON said that in cases like the one cited by Dr. Green he thought it would be wiser to cover the perforation with omentum, which would act the same as a suture in closing the opening and preventing leakage. In most of the cases in which the perforation was converted into a gastric fistula the patients had died of inanition, whereas the same purpose could have been served by sewing omentum over the opening, which could be done very quickly.

DR. ELIOT said that about two years ago, in an article on this subject by Conrad Brunner, and later, in an article by the speaker on perforated duodenal ulcer, a careful review of the literature revealed only a single instance of a gastrostomy of this kind that ended in recovery. In some twelve or fourteen other cases reported, death had occurred from inanition or peritonitis or some other cause.

TUBERCULOSIS OF THE SPLEEN.

DR. FORBES HAWKES presented a boy, eight years old, whose previous history had been negative, excepting for constipation, until June 1, 1910. He had then suffered from an attack of gastro-enteritis, but this had not been severe enough to confine him to bed. Toward the end of June, a swelling in the ab-

dominal region appeared. The boy's mother thought that during this time he had lost slightly in weight.

On examination, the boy's throat was found to be slightly reddened, and a culture revealed the presence of diphtheria bacilli and staphylococci. A large spleen was made out, occupying the umbilical region. The blood count was normal. The patient was isolated for a few days, until the diphtheria bacilli disappeared from the cultures. He was then taken back to the ward, and kept under observation. The spleen, which had previously been movable, was then found to be distinctly less so, and tenderness appeared over it. A few days later the spleen became markedly adherent. An operation disclosed œdema of the overlying muscles, and a large, soft, granular spleen fixed to the abdominal wall. Two sections of splenic tissue were removed. The peritoneal cavity was opened above the spleen. Several omental nodules were seen where the omentum had become adherent to the spleen, and there was also one nodule on the dome of the liver. Several of these nodules were removed for examination.

The microscopic report of the sections of the spleen and the omental nodules showed tuberculosis. Cultures from the peritoneal cavity showed staphylococci. The patient did well after the operation, with the exception of a severe bronchitis, which subsided in a few days. The wound was slow to heal, and still showed a scabby area in its upper part. The patient had gained in weight and his constipation had been relieved.

The case was regarded as one of tuberculosis of the spleen, with secondary infection from the throat.

OPEN OPERATION FOR SEPARATION OF UPPER EPIPHYSIS OF HUMERUS.

DR. HAWKES presented a boy, seven years old, who on July 5, 1910, fell from a fire escape, a distance of about twelve feet, striking on his left shoulder. He sustained what proved under the X-ray to be an epiphyseal separation of the head of the left humerus. The upper fragment was situated below the glenoid fossa. As manipulation under a general anæsthetic was ineffectual in approximating the fractured surfaces, an open operation was done. It was found that the shaft of the humerus, after its head had been fractured, had pushed its way through the capsule of the joint upwards, and presented directly under

the skin. The capsule had nipped the shaft so that bloodless reduction had been rendered impossible.

The edges of this portion of the capsule were held apart by retractors, and through this opening the projecting part of the shaft was brought down. The upper fragment was then pried back into place with a periosteal elevator, and sutured to the shaft by a chromicized catgut suture passed through holes drilled into the bones near the fractured surfaces. The edges of the split capsule were then brought together with chromicized catgut. The arm was put up in a position of moderate abduction, this being the position in which tension on the fragments seemed to be least felt.

The boy made an excellent recovery. Passive motion was begun on the tenth day, and he now has excellent use of the arm. Only slight thickening could be felt at the site of the fracture.

THE TREATMENT OF SPREADING PERITONITIS.

DR. JOHN A. HARTWELL presented twelve cases in which there had been present extensive spreading peritonitis following appendicitis, which had come under his care during the past summer, in the Presbyterian Hospital. For the privilege of operating on them he expressed his thanks to Drs. Eliot, Woolsey, and Hawkes, of the attending staff. All these cases had been treated in the same general way, and all had recovered, so that an analysis of the conditions found and the results might be of value in deciding some unsettled points concerning them. Eight were males and four were females. The youngest was eight years old and the oldest was forty; five were children under thirteen. Nine were suffering from their first attack, two from their second, and one from his third. Five were operated upon about 24 hours after the onset of acute symptoms; one on the second day, two on the fourth day, one on the seventh, and one on the ninth. All, without exception, showed evidence of a more or less extensive peritoneal inflammation by the presence of general rigidity and general tenderness, and in four cases by dulness in both flanks. Seven cases were considered seriously sick, as judged by the pulse-rate, respiration, general appearance, and the abdominal signs. The remaining five, while giving evidence of very considerable toxæmia, could not be classed as unfavorable cases. Only

three of the entire twelve could be classed as desperate cases.

The findings with regard to the white blood-corpuscles were interesting: the leucocytosis varied from 9000 to 30,000 in the ten cases, where it was recorded before operation, and the polynucleosis from 73 per cent. to 96 per cent. There was no relation whatever between the severity of the infection, as judged from general and local findings, and either the increase in total leucocytes or polynuclear leucocytes, nor did the severity of the postoperative course seem to depend in any way upon the reactive power as shown by the leucocyte count. In the two cases, however, where the count remained close to the normal, the condition at operation was found less extensive than in the others. One man with 16,000 leucocytes and 96 per cent. polynuclear cells made a very prompt recovery, although the intraperitoneal infection was very extensive. One woman having 11,000 leucocytes with 90 per cent. polynuclears showed a severe and general peritoneal inflammation, and made a very prompt recovery. On the other hand, a man having 24,000 white cells, 80 per cent. being polynuclear, showed no evidence of being seriously sick. At operation he showed the least peritoneal involvement of the whole series, yet his convalescence was among the most severe. It seemed fair to conclude that with a spreading peritonitis, the findings as regarded leucocytosis and polynucleosis were of no value in determining either the severity of the lesion or the prognosis.

A gangrenous appendix, either in whole or part, was found to be the cause of the peritonitis in each of the twelve cases. In ten cases pus was found in the subhepatic pocket, the pelvis, and the subsplenic pocket, showing that an infection process existed in practically the whole of the greater peritoneal pouch. In one case the right side and the pelvis only were involved, and in another the pus seemed to be confined to the cæcal region and the pelvic cavity. In the latter case, the postoperative course was among the most severe, although prior to operation the man did not seem to be seriously ill. In several of the cases pus was found occupying the spaces among the small intestinal coils in the umbilical region. In five cases it was noted in the history that the peritoneal coat of the intestines, so far as could be observed, showed marked inflammation. In two, absence of such a condition was noted, and one of these was the most seriously sick of the whole series. In the remaining five no mention of this condition was made, which was pre-

sumptive evidence that the serosa did not show an inflamed condition.

The management of all the cases was practically the same, modification being made only to meet special indications. All were prepared by the emergency iodine method, and were operated upon within an hour after admission. The preparation was completed and the sterile sheets placed before the beginning of anæsthesia, which was produced by nitrous oxide and ether. The incision was made over the mass, when such existed; otherwise it was made at the usual site. The appendix was removed by simple section at the base, after ligation, and the stump was cauterized with carbolic acid and alcohol. Burial of the stump was not practised because the conditions were not favorable, and the time this would have required was a distinct loss to the patient. The presence of pus in the pelvis and right flank was determined by means of a gauze sponge. If found, the table was elevated to an angle of fifteen degrees, with the head up; the return flow syphon tube devised by Blake was connected with an irrigator of hot, normal saline solution, and after the flow was established, filling the tube, the flow was temporarily stopped and the tube introduced along the anterior abdominal parietes and then downward to the pelvic floor. On again starting the flow the syphonage immediately began, and the saline solution, mixed with pus, promptly flowed from the exit tube. This was continued until the water returned clear. The tube was then cautiously introduced in the same manner into the left mesenteric gutter, and if the return flow showed pus, the procedure was continued until that region was clean. The right gutter was then attacked, and, if necessary, the coils of intestine in the midabdominal region. These procedures always resulted in the washing of some pus into the pelvis, and this was therefore again washed out. In one case, about sixteen gallons of solution were required to complete the washing, and in many of the cases from six to eight gallons were used. This washing required some practice to get the best results: the height of the irrigator, the length of the outflow syphon tube, the slant of the table, and the position of the solid tube all needed some slight modifications in individual cases.

Another point of importance was that the edges of the wound should be held snugly around the tube so that a return flow did not take place along it instead of through the syphon. If care be exercised, the separate pockets holding the pus could

be emptied with practically no soiling of the non-affected parts, and at the conclusion the operator felt comfortably sure that no free pus remained in the peritoneal cavity. The procedure was attended with practically no shock. The time consumed by the cleansing was from three to ten minutes. A drain, usually a cigarette, was passed into the pelvis, and if necrotic tissue existed around the cæcum, a second one was inserted at that point. The abdominal wound was sutured sufficiently to guard against intestinal prolapse, and a dressing applied. The entire operation in cases where no difficulty was encountered in getting out the appendix occupied less than fifteen minutes, and the usual time was from twelve to twenty minutes. At the close of the operation a lavage was done unless it had been done for special reasons previously, and the patient was put to bed with the head and shoulders elevated either by raising the whole bed or by using a bed rest, this being determined by which position was the more comfortable for the individual patient.

The contrast between many of these patients immediately before operation and on their return to consciousness from anæsthesia was marked. The abdomen changed from a condition of board-like rigidity to a normal relaxed state, and excepting over the wound showed no tenderness to palpation. The evidence of suffering had often entirely disappeared, and it was not an unusual thing to hear the patient say within a few hours that he felt quite well.

The after-treatment was as follows: Enteroclysis by the drop method was established and continued for several hours, remitting it when the colon showed any evidence of intolerance or became over-filled. Lavage was done when vomiting was troublesome, or when gastric distention was present, often being repeated three or four times in the day. Nothing was given by mouth for 24 hours. Morphine, hypodermically, was given sparingly if the pain recurred severely. If the distention became at all marked, turpentine stupes were given, the wound being protected by rubber tissue and chloroform, and these were supplemented by turpentine, oil, ox-gall, or Epsom salts enemata, or a combination of them. Nourishment was withheld until it was demonstrated that intestinal paresis need not be feared. In one or two cases this abstinence from nourishment covered a period of four days. The first nourishment was in the form of a small amount of broth and albumin water; if this was well borne the quantity was gradually increased, and then other easily

digested articles were added, milk being withheld until the bowels were moving well and distention was absent. Cathartics were used sparingly, and usually not given until after 48 hours. As soon as the digestive functions became normal, the diet was gradually increased, and then given liberally to repair the loss of strength.

The drain was usually loosened about 36 hours after operation, and was then gradually drawn out and shortened. After four days it consisted, as a rule, of only a drain for the parietes.

Results.—All of these twelve patients recovered. Two developed a small patch of pneumonia, and one a left-sided phlebitis in the femoral vein. The remaining nine had no complications. One fecal fistula developed, and no secondary abscesses. The patients left the wards to return for wound dressings in from ten to thirty days, four being discharged in less than two weeks, and four others in less than three weeks. Many of them, including those who showed a temporary cessation of pain and distention immediately after the operation, again suffered from these symptoms, and there was no evident relation between these symptoms and the severity of the condition found at operation. The most severe case in the series, a woman who remained in a precarious condition for six days, had neither, while the least extensive case, in which the pelvis alone was involved, and one of the least sick before operation, suffered severely from both for nearly a week, but his general condition remained excellent.

Dr. Hartwell said that while twelve cases were too few to establish any advantage of the treatment used here over other methods, yet the results were sufficiently promising to have this general method tried. It was in no particular a new method, but was presented as an added link in favor of the cleansing of the peritoneum as against leaving the contained pus to be taken care of by the patient.

DR. GEORGE D. STEWART asked Dr. Hartwell if an examination was made to determine the variety of germ responsible for the peritonitis. That, the speaker thought, had something to do with the severity of the peritonitis. He believed all would agree that cases, which in the onset looked comparatively mild, might eventually give rise to very severe symptoms.

In the ordinary operation for appendicitis it was very difficult to judge how extensive a peritonitis existed; the surgeon did

not always expose the entire abdomen if he had a reasonable hope that the pus had not spread far from the site of the operation.

The question of whether to flush or not to flush the peritoneal cavity was still unsettled. Personally, he had largely given up this procedure, preferring to wipe out the pus rather than flush it out, and he had a conviction that his results were better by the former method. Of course, most surgeons, he believed, had adopted the Murphy method of irrigation, or some modification thereof, and the Fowler position, both of which he thought were very useful.

DR. ROBERT T. MORRIS said his experience was very similar to that of Dr. Stewart. He first began by wiping out the pus, then he substituted flushing, and now he felt that wick drainage usually sufficed. The flushing method naturally appealed to a man on account of its neatness, but he questioned its necessity in the majority of cases. He believed in making cultures from the pus, which in many instances would be found sterile. In another class of cases of general spreading peritonitis, with pus over the entire peritoneum, we found the *Staphylococcus albus* as causative factor, and that pus was better left undisturbed, because the bacilli were not at work there; they were at work in the tissues and the pus was commonly sterile. There were still other cases in which bacteria of various kinds were found in the pus, and in dealing with those cases, any successful method was a good method. Dr. Hartwell had been successful with his method and therefore it was a good method. The great *desideratum*, however, was to simplify our methods as much as possible, and if we can treat these cases successfully by capillary drainage through a small incision and quick work, it is certainly a step in the right direction. The speaker said that the latter method had been successful in his hands; it might not be successful in the hands of others. The escape of the stream by capillarity must be encouraged by frequently changing the external gauze. This mechanical point is of pivotal importance.

DR. IRVING S. HAYNES said he was practically in accord with the views expressed by Dr. Morris. After an opening had been made in the abdominal wall, the intra-abdominal pressure would do the rest, and a small piece of rubber tissue carried down well into the pockets offered an exit for the pus. The speaker

said he had formerly irrigated with great vigor, but had given up the method. In addition to the rubber tissue drainage, he employed Fowler's position and capillary irrigation.

DR. PARKER SYMS said he was glad to hear that Dr. Hartwell favored an immediate operation in these acute cases, irrespective of the time at which the opportunity came. That was a question, Dr. Syms said, which he submitted to this Society for discussion some years ago, and he was in favor of operating, no matter at what period of time the surgeon first saw the case.

As to the method of operating, the speaker said he believed in removing the appendix in almost every case, breaking up the pockets of pus, and supplying drainage, but he never resorted to flushing, and he had become convinced that the less the peritoneum was handled, the better for the patient.

DR. GERSTER said he would like to ask those gentlemen who operated through a small incision how they knew that there was a general peritonitis? Upon what symptoms or physical signs did they base their diagnosis or assumption? And, furthermore, how could these cases be classified as general peritonitis and included in statistics? Personally, he believed that much that had been said about the statistics of general peritonitis was worthless, because diagnosis could not be confirmed in many of the cases that had been included. The type of the bacterial infection in these cases had also been referred to, but all these features were exceedingly vague, and we simply knew that the statistics adduced by some operators were exceedingly favorable, while those of others were quite the opposite. Senn used to say he did not believe that a patient had had general peritonitis unless that patient had died. When we were dealing with a peritonitis resulting from the perforation of an abdominal viscus, we generally had a tractable disease providing the case was seen sufficiently early: in such cases it made no particular difference whether one made a small or a large incision, whether one flushed or did not flush, or how one treated them. But there was another type of peritonitis that had not been mentioned at all. For example, a case was diagnosed as appendicitis, the appendix was removed, and apparently the patient was doing well. Suddenly, after a number of days, there developed all the symptoms of shock and perforation, and the patient soon died if nothing was done and usually even after something was

done. What was the probable course of events in such a case? There was an abscess, perhaps originally communicating with the appendix, but which had become separated from it by adhesions. This abscess which was left behind continued to grow and suddenly ruptured, flooding the peritoneal cavity with a large quantity of virulent pus. Many patients who were supposed to have died of peritonitis really died as the result of phlegmonous processes in the retroperitoneal cavity that were not recognized even at post-mortem examination. Those were the cases one could not cure with flushing or without flushing. They were bound to die, because the conditions were such that the lesions were not accessible to surgical treatment.

Dr. Gerster said that in their cases of spreading peritonitis at Mt. Sinai Hospital they opened the abdomen as soon as possible, eliminated the leakage, established drainage without preceding irrigation, placed the patient in Fowler's position, and by this method saved 86 patients out of a hundred.

DR. WILLY MEYER said he thought the question of which method was preferable in the toilet of the peritoneum—whether by flushing or dry sponging—was not yet settled. Personally, he had never flushed, and his results had been satisfactory. Dr. Franz Torek, one of the attending surgeons of the German Hospital, on the other hand, had treated his cases of general suppurative peritonitis by making a long median incision, removing the appendix, searching out every possible pocket of pus, flushing as long as he thought necessary, and then closing the entire cavity without drainage, and his results had been excellent. Out of some sixteen cases, all but one or two had been saved.

DR. CHARLES H. PECK said he had been following Dr. Hartwell's method for six years at the Roosevelt Hospital, and he had come to the conclusion that the factor of prime importance in these cases was to produce as little traumatism as possible, and do as rapid an operation as possible. If pus was found, for example, in the right iliac fossa and could be readily sponged out, he saw no objection to doing it, but if the pus was more generally distributed he thought it could be more quickly removed through the Blake tube with syphon return than in any other way. By the appearance of the return flow one could readily tell whether there was any pus up under the liver or in the subphrenic space or elsewhere, and it was not unusual

to get a turbid return flow from obscure regions which could not be reached by sponging. For small localized collections of pus which were readily accessible, sponging answered the purpose.

DR. MOSCHCOWITZ, referring to the question of the various bacteria present in peritonitis, said that at Mt. Sinai Hospital cultures were made in every case, and their experience had led them to practically disregard the presence of any particular bacteria, as they had found that the streptococci, the *Bacillus coli* and the *Streptococcus aureus* gave about the same mortality, whether alone or in combination. That was the result of their experience in five or six hundred cases.

The important question to decide in connection with this subject was what was and what was not peritonitis. The methods of treatment in these cases were about as divergent as the results reported. Some surgeons did not even wipe out all the pus, while others did a radical operation, and the results were practically the same. The difference in the mortality statistics, ranging from 5 to 50 per cent., probably depended on what class of cases were included under the name of peritonitis.

DR. MORRIS called attention to the fact that the *Staphylococcus albus* quickly developing over the peritoneum called out protective leucocytosis and then died, so that no micro-organism might be found, although it had protected the patient, and left sterile pus.

DR. HARTWELL, in closing, said the various speakers showed practically the same differences of opinion as were elicited when this subject was brought up for discussion some time ago.

In answer to Dr. Gerster, the speaker said he did not know whether the cases he had reported were examples of general peritonitis or not, and he had given the exact regions of the abdominal cavity where the pus was found. In all but two it was found under the liver, under the spleen, and in the pelvis. By flushing with Blake's tube it was comparatively easy to reach all the small peritoneal pockets, and the procedure only occupied a few minutes. It must, however, be done carefully, and some practice is needed to get the best results.

INTUSSUSCEPTION, WITH SPECIAL REFERENCE TO ADULTS.

DR. ELLSWORTH ELIOT, JR., read a paper with this title, for which see the February issue of the ANNALS OF SURGERY.

BOOK REVIEWS.

SURGICAL AFTER-TREATMENT. BY L. R. G. CRANDON, A.M., M.D. Boston, 1910, W. B. Saunders Company, Philadelphia.

Many books dealing with the immediate treatment of surgical diseases have been written. There are also some excellent publications dealing with the preparation of patients for operations. This book occupies a third special field, that of the after-care of surgical cases. It is important because the immediate treatment has always monopolized the attention of surgical writers, and too little has been said of the after-attentions upon which the recovery or cure of the patient often depends.

This book has been written for house surgeons in hospitals and for general practitioners in communities which are not surgical centres and in which the general practitioner must assume the after-care of surgical cases. The book describes tried methods. The reader is made familiar with the details of the elevated head position. The discussion of anæsthesia is practical, although neither the tongue forceps nor the mouth gag, on page 30, will find general approval.

One of the valuable features of this book are the illustrations showing both how things sometimes are improperly done and how they should be done. The relief of post-operative thirst is well discussed. Proctoclysis and saline infusion are described in this connection. The technic of transfusion is quoted largely from Crile. The discussion of the treatment of shock is complete. The author has given the modern view of this subject, but, in his zeal to omit nothing, he has included both alcohol and strychnine. While he shows these two old friends rather scant courtesy, still they are admitted to the company of therapeutic agents.

The emergencies which follow operations, one realizes, make so large a catalogue that their discussion in a work on general surgery is difficult. In such a special work as this they may

be fully treated. Here we find discussed with fulness that is sufficient, such conditions as post-operative hemorrhage, coma, collapse, thrombophlebitis, and the various infections. Resuscitation by artificial respiration, oxygen, and electricity are described. Is it not possible that surgeons make too little use of intubation and insufflation of the lungs with oxygen or forced aeration?

In discussing diet during convalescence, the author wisely suggests that the surgeon should not attempt too much, but should give the patient a wide latitude. The patient who is reasonable knows what he likes and can take with satisfaction, and is to a large degree a specialist in his own digestion. Rectal feeding is elaborated in its technic and principles. Formulæ are given. Gavage and other forms of artificial feeding are described.

Catheterization, care of the bowels, and stomach disturbances receive practical attention. The dangers of magnesium sulphate are mentioned.

Any case of post-operative tympanites which progresses in spite of treatment should be considered operative. Delay in intestinal obstruction is far more serious than operation. Operation must usually be done while there is still some doubt as to its necessity. If it is done when there is no doubt, it is usually too late.

A chapter on bandaging describes the most useful bandages. All are effective, though not beautiful. The chapters on the treatment of operative wounds present the indications and methods of dressing. An excellent résumé of the Bier hyperæmic treatment is given. The treatment of sinuses is briefly described. In the treatment of septicæmia we again encounter whiskey and strychnine. Hæmophilia is discussed with especial reference to the use of blood-serums. An idea of the thoroughness of the book may be had from the fact that the author has included post-operative psychoses, artificial limbs, massage, and electrotherapy. A chapter on preparation of the patient for operation seems like a gratuity in a book on after-treatment and surgical convalescence.

The wisdom of the author is displayed in his statement that, "nearly all that has been said as to the value of out-of-door

life and sunshine in surgical tuberculosis applies to the healing of all wounds and to surgical convalescence in general. The much vaunted air of the Engadine is, after all, only pure air, and we need not cross the ocean to find that."

Post-operative hernia, adhesions, foreign bodies left in the abdomen, and the use of abdominal binders are briefly presented. The author speaks against the prolonged use of the binder, and quotes Abel, who showed that the abdominal swathe has nothing to do with preventing the formation of hernia.

It is something of a surprise to find in a work emanating from the cultured atmosphere of Boston, that it is the custom "to operate these infants" (page 365), when the author means to operate upon them. He operates others also elsewhere in the book.

These general subjects take about one-half of the book. The second half is devoted largely to regional surgery. This latter is the more important part. It details the after-treatment in all of the ordinary operations of surgery.

The largest chapter in the book is that on vaccine therapy. The subject is well covered. While this is properly a part of immediate rather than later surgical treatment, its importance at this period of its development is so great that any surgeon who buys a book on therapy is glad to find it. More than 170 pages are given to the subject. A series of receipts for convalescents' foods closes the book.

Dr. Crandon has written a useful book. It is a valuable supplement to the works on general and special surgery. It is practical. While it draws much from the general literature of surgery, as such a work must, it displays the judgment of an experienced surgeon. Many of the illustrations are poor. So long as publishers place upon authors the financial burden of supplying illustrations, good books with poor illustrations must be published.

J. P. WARBASE.

SURGICAL ANATOMY. By JOHN A. C. MACEWEN, Assistant Surgeon to the Royal Infirmary, Glasgow, etc. New York, William Wood & Company, 1910.

The appearance during the last few years of an unusual number of works on surgical or applied anatomy is a fair

indication of a demand for a more accurate knowledge of those structures and regions which have a peculiar interest for the surgeon.

This work consists of 478 pages, with 61 illustrations; of this number 18 are original, the remainder being borrowed from standard works.

The author divides the subject into five sections, corresponding to the five natural divisions of the body.

Section I: Head and Neck, Vertebral Column, Brain and Spinal Cord. Section II: Thorax. Section III: Abdomen and Pelvis. Section IV: Lower Extremity. Section V: Upper Extremity.

The general plan of this work is, first, a consideration of the structures as they are related regionally, and next, an estimate of their clinical values and presentation of the practical problems with which they are associated.

In a work of this character an author can scarcely hope to present many new facts. The threads with which he weaves are the products of many minds and the accumulations of many years. His chief aim must be to sift, compare, and fix the clinical values of the anatomic facts, and thus clothe them with living interest.

The author has succeeded in presenting a concise account of the anatomical facts of importance to the surgeon. There are, however, a few omissions and some commissions which are too important to escape just criticism.

The author's estimate of wry-neck is conventional and hackneyed. Gerdes has shown in connection with permanent wry-neck that the scalenus anticus is as frequently at fault as the sternomastoid and should be divided with the sternomastoid. Furthermore, division of the muscle *subcutaneously* is neither to be taught nor practised. There is no excuse for "blind" surgery in the light of modern technic.

The author in his preface explicitly states that he surveys the anatomy of hernia from the abdominal instead of from the external surface, and yet he omits to mention the one fact which elucidates the anatomy of the inguinal canal. For no adequate conception of the inguinal canal is possible without reviewing the evolution of the testicle—its formation within

the abdomen, its descent through the abdominal wall, and its final arrival in the scrotum.

There is no mention made of the important fact concerning the renal circulation first suggested by Hyrtl and later developed by Brödel, viz.: that the kidney is vascularized by two arterial systems and that between them is a non-vascular zone, along which an incision may be made through the substance of the kidney with a minimum amount of hemorrhage.

The statement of the author that "nephrectomy is generally performed through an abdominal incision" does not conform with the practice of American surgeons.

WILLIAM FRANCIS CAMPBELL.

THE RÖNTGEN RAY IN PÆDIATRIC PRACTICE. By DR. THOMAS MORGAN ROTCH. 8vo; 224 pages in the text and 264 plates. Published by J. B. Lippincott Company.

In reviewing a book that deals with a comparatively new feature in pædiatric work, it is very difficult to place a fair estimate upon it. Dr. Rotch has led us in his recent book into a field that is peculiarly his own. He has ideas and has had the ability to place them before us in an interesting as well as instructive way. The text of the book is really its less important feature; the illustrations are numerous, well selected, and withal very instructive. It is one of those books that cannot demonstrate its real value until sufficient time has elapsed to test its practicability. In other words, the present volume must "find itself" by a demonstration of the practical value of its teachings. Throughout the text we find the evidences of the enthusiasm of the writer, and the claims which are made under the influence of this enthusiasm can hardly all be borne out in practical application. It is a volume that excites thought, and any book that does that is a valuable addition to medical literature.

The real test of the value of the work done by Dr. Rotch and the saneness of his deductions will come when a large number of observers have had the opportunity to test out in practical application some of the suggestions laid down. The book should be added to the library of every pædiatrist, and it is not without considerable value to the surgeon.

LE GRAND KERR.

VARIATIONS OF THE BONES OF THE HANDS AND FEET. A Clinical Atlas. By THOMAS DWIGHT, M.D., LL.D. Parkman Professor of Anatomy at the Harvard Medical School. With 36 plates and 79 figures. J. B. Lippincott Company, Philadelphia and London.

This is a book of wonderfully clear X-ray plates. These plates show far better what the author wishes to teach than words alone could. The descriptions are clear, concise and to the point. It is not purely an anatomical study, but a very needy book for the surgeon, orthopædist and the general man as well.

By his plates he shows numerous variations in size, shape, position, and division of the bones. This has a great bearing on anatomy and surgery. The development and placing of extra bones is important. Extra bones are sometimes so placed that they simulate fracture. This is shown, and explained to one's full satisfaction. Taking one bone of the wrist—the scaphoid—the author clears up some mistaken diagnoses. This develops frequently as two separate bones and is called the divided scaphoid. This, of course, may appear under the X-ray as a fracture. The author says in regard to diagnosis of this condition: "I am far from questioning the diagnosis in many cases of fracture of the scaphoid. I do not deny that a normal bone may be broken, but strongly suspect that in most cases called fractures there was a subdivided bone to begin with." Plate 1, Fig. 2, and Plate 2, Fig. 5, show this subdivision. There are numerous other valuable points through the book.

NORMAN PHILIP GEIS.

ANNALS OF SURGERY

VOL. LIII

FEBRUARY, 1911

No. 2

ORIGINAL MEMOIRS.

ANÆSTHESIA BY THE INTRATRACHEAL INSUFF- FLATION OF AIR AND ETHER.*

A DESCRIPTION OF THE TECHNIC OF THE METHOD AND OF A PORTABLE
APPARATUS FOR USE IN MAN.

BY CHARLES A. ELSBERG, M.D.,

OF NEW YORK,

Surgeon to the Neurological Institute; Adjunct Surgeon to Mount Sinai Hospital.

IN previous papers ¹ I have considered the practical aspects of anæsthesia by intratracheal insufflation of air and ether, and have reported concerning several patients who were anæsthetized by the method of Meltzer and Auer. In a future paper I expect to report upon a number of intrathoracic operations performed by means of intratracheal insufflation, and upon our experiences with the method for purposes of artificial respiration.

This paper shall be devoted to the subject of the anæsthesia itself, with special reference to the technic of the method.

The apparatus for intratracheal insufflation should be as simple as possible and should be portable. While a very small and inexpensive apparatus worked by means of a hand pump

* Read before the New York Surgical Society, November 23, 1910.

¹ Medical Record, March 19, 1910; ANNALS OF SURGERY, July, 1910; Berliner klin. Wochenschrift, October, 1910.

or a foot bellows could easily be devised, I have considered that an easily managed automatic apparatus would be much preferable, and have, therefore, with the help of Dr. S. Yankauer, of this city, and of Tiemann & Co., instrument makers, constructed the apparatus which is described in what follows.

The entire apparatus is contained in a wooden box which is $38\frac{1}{2}$ inches long, 11 inches deep, and 18 inches wide. It is easily transportable (Fig. 1). The box is placed on the floor near the head end of the operating table and the front turned down² (Fig. 2), exposing the interior which contains the following (Fig. 3): By means of the switch *A* and the rheostat *B* the electric current is carried to the $\frac{1}{6}$ horse-power motor *C* which drives the blower *D*. The air passes through the tube *E* and the oil filter *F* and the tube *G* into the bottle *H*. This bottle contains hot water, so that the air, as it bubbles through the water, is warmed, moistened, and filtered. The current of air then passes through the tube *I* to the rubber tube which is connected to the intratracheal catheter. To this tube (*I*) is connected the ether reservoir *J*.

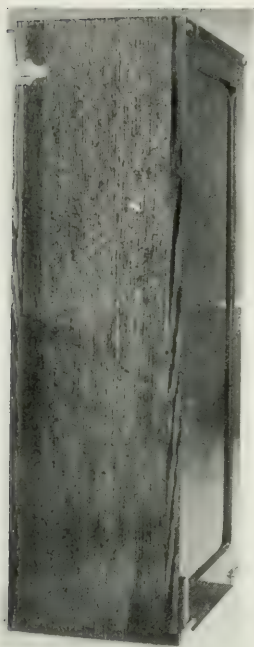
The ether reservoir consists of a glass jar which is held air tight against its cover by a spring clamp below. The cover contains the openings of two tubes (*X*, *X'*) which are connected with the main tube *I*. The hand wheel *K* which moves an indicator on a scale above it, is arranged to control the air passing through the tube *I*. When the indicator stands at zero at the scale, pure air is passing through the tube *I*. As the indicator is turned, more and more of the air is diverted into the one tube (*X*) which leads into the ether reservoir. When full ether is turned on, all of the air has to pass into the ether reservoir and over the surface of the ether, so that it becomes saturated with ether vapor. When the indicator shows that pure air is passing through the tube *I*, the tubes which lead into the ether reservoir are closed, and the ether reservoir can be removed if necessary and refilled.

The manometer *L* is connected with the tube *I* and records the pressure of the air current which is flowing through it. The ends of the manometer tube have hard rubber stop-cocks which can be closed when the apparatus is to be transported,—a possible spilling of the mercury in the manometer is thus prevented.

The tube *M* leads into the main tube *G*, has also a stop-cock, and to its tip the tube from an oxygen tank can be connected so that oxygen can be added to the air if desired. The tube *P* leads to a foot bellows which has been added to the apparatus as a safety device, if anything should happen to the motor or blower, or is to be used where no electric current is available. When the stop-cock *N* is closed and *O* is opened,

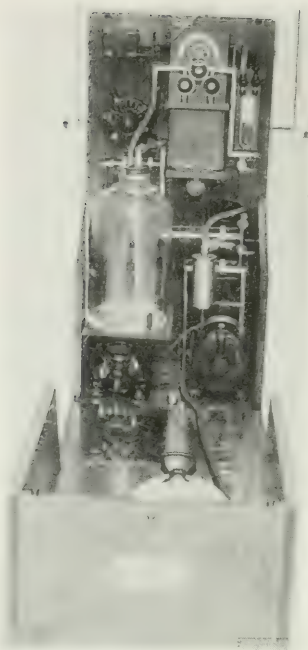
² The box is now arranged so that the front can be entirely removed.

FIG. 1.



Box containing insufflation apparatus.

FIG. 2.



Front of box turned down to show the apparatus.

FIG. 3.

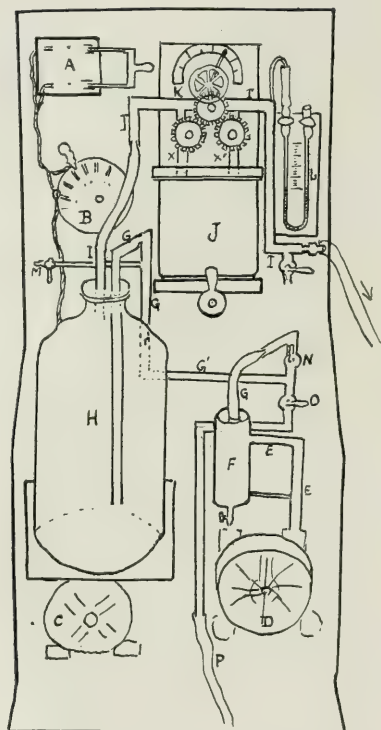
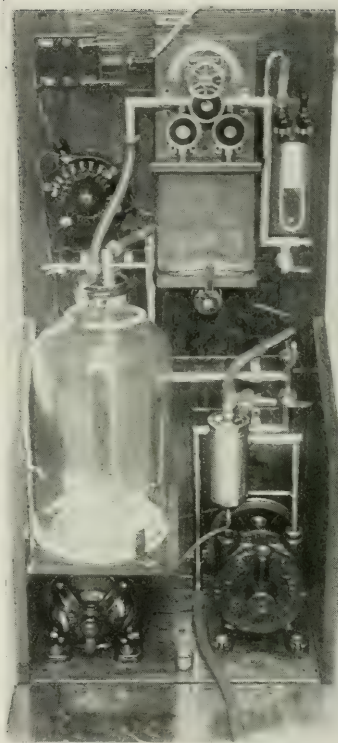


FIG. 4.



Front of box removed, showing the entire apparatus (excepting the foot bellows). The letters in Fig. 3 correspond to the letters in the text, and to the parts in Fig. 4.

and the foot bellows used, the air passes into the tube *G'* and into the water bottle. When the stop-cock *N* is open and *O* is closed, no air can enter the main tube from the bellows, and air passes to the water bottle from the blower. It takes only a moment to turn the two stop-cocks so that one can in a moment switch from air from the blower to air from the foot bellows and *vice versa*.

The water bottle *H* is held firmly in place by a clamp. The tubes from it are connected to the main tube by bayonet joints so that the bottle can be easily removed when it is to be filled or emptied. The perforated cork is held firmly and air tight by a clamp.

The apparatus and its handling are simple. When it is to be used, the water bottle is first one-third filled with hot water, the stop-cocks on the manometer opened, the stop-cock *N* open and *O* closed, the switch turned on, the rheostat turned on full, and the motor and blower thus set in motion. The stop-cock *M* is left wide open. As soon as the apparatus has been connected with the intratracheal tube the stop-cock *M* is slowly turned until the manometer shows that the pressure of the air is 20 mm.

The percentage of ether is regulated according to the depth of the anæsthesia; usually the indicator has to be turned until it shows that half or full ether is being used.

By means of the stop-cock at *I* (below the manometer) the air and ether current can be diverted from the intratracheal tube so that no air enters the intratracheal tube but all of it escapes through the open stop-cock.

The management of this apparatus is, as I have said, extremely easy. From the moment that the power is turned on and the pressure regulated, the anæsthetist has nothing to do but watch the pressure gauge and occasionally interrupt the current of air so as to momentarily collapse the lungs. He can be seated at some distance from the operating table and will be out of the way of the operator and his assistants; or he can be seated near the table so as to control the pulse of the patient.

The Catheter or Tube to be Used, and the Method of Introduction.—The tube which is to be introduced into the trachea must be fairly rigid so that it cannot be coughed out of the trachea when it is once in place. After much investigation I have found that this requirement is best met by a silk-woven catheter. It should have an opening at or near its end. It must be at least 30 cm. long. The ordinary silk-woven urethral catheter will do very well; this has the advan-

tage that it can be obtained anywhere. The catheter should have two marks upon it: one, 12 cm. from the tip, a second mark 26 cm. from the tip. The average length of the adult trachea is 12 to 13 cm., of the larynx, 5 cm.; in the adult, the average distance from the incisor teeth to the glottis is 14 cm. Therefore if the tip of the intratracheal tube is 26 cm. from the incisor teeth, it will lie 5 cm. or less above the bifurcation of the trachea.

The *size* of the catheter must, of course, vary with the diameter of the trachea and size of the larynx. For the adult it is advisable to use a tube whose diameter measures about one-half of the length of the glottis as seen through the direct laryngoscope. This will in general correspond to a size No. 22 to 26 of the French scale. In the majority of instances a catheter No. 22 or 24 French will be found of suitable size.

In children, the catheter must be correspondingly smaller. The length of the catheter in the trachea varies somewhat, but I have found that in general the length of tube below the glottis measures about the same as the length of tube from the glottis to the incisor teeth. In other words, if the tube has been introduced as far as the glottis, it will have to be pushed again as far downwards to have the tip in the proper part of the trachea.

The Introduction of the Tube.—After much investigation, I have found that the tube can be most easily and quickly introduced when the larynx is in plain view. This can be easily accomplished by means of the Jackson direct laryngoscope. As is well known, this instrument is used for the introduction of the bronchoscope. It is easy of manipulation, and with very little practice one can, by its means, obtain an admirable view of the glottis, so that the tube can be readily introduced between the vocal cords. For all of us who are not trained laryngologists this method will be found to offer the advantages of simplicity combined with certainty.

Before the tube is introduced, the patient should be given a dose of morphine and atropine and then be anæsthetized in the usual manner with ether. When the patient is well

under, he is brought into the operating room and placed upon the operating table, with the head hanging well downward over the end of the table and the mouth held open with an ordinary mouth gag.³ The direct laryngoscope is then introduced and pushed along the posterior wall of the pharynx until the epiglottis is in plain view. The epiglottis is pulled well forward by the beak of the instrument and the glottis well exposed. One usually obtains a fine view of the larynx, can clearly see the opening between the cords, and can estimate its size and length. A catheter whose outside diameter measures about one-half of the length of the glottis is then selected. This is introduced through the laryngoscope and into and through the larynx. The tube is then pushed forward until the second mark on it shows that the tip is 3 to 5 cm. above the bifurcation of the trachea. Air will now be heard rushing in and out through the catheter. At this stage, the patient may have a spasm of the larynx for a few moments. This need not cause concern; respiration will soon begin again. The tube is now held in place and the laryngoscope withdrawn, the manipulations thus far having occupied only a few minutes.

To hold the tube in place, I first devised a special mouth gag or bit. It is called a bit because it is held against the upper teeth by means of a strap around the patient's head. It consists of a plate of hard rubber, held against the upper teeth, which has a central opening for the intratracheal tube. When the tube has been passed through the bit it is held immovable by a small steel spring clip, so that it (the tube) cannot be pulled out or pushed in. At the present time I use an elastic wire shaped to fit over the ears like a pair of spectacles. The wire runs just below the nose and has a small clip to hold the intratracheal tube.

The connecting tip of the tube which leads from the insufflation apparatus and from which the mixture of air and ether is flowing is now connected with the intratracheal tube, and

³ Preliminary cocaineization of the larynx is unnecessary.

the anæsthesia begun. By means of the stop-cock (*M*) the pressure is regulated so that the manometer registers 20 mm., and full ether is turned on. In many patients it is only necessary to keep the ether index at 50, in others full ether is required.

The Course of the Anæsthesia.—In all but one of the patients whom I have anæsthetized in this manner the anæsthesia was complete. That is, the patients were quiet, their musculature was relaxed, they breathed quietly and superficially. Auscultation of the mouth showed that the air was issuing from the buccal cavity in a continuous stream. In many but not in all of the patients the respiratory movements ceased altogether when the pressure was raised so that the manometer registered 30 to 40 mm., and apnœa ensued. It may well be that in some patients a pressure higher than 40 mm. of mercury is required to distend the lungs fully and thus cause the apnœa which is regularly observed in dogs when the lungs are markedly distended.

If the tube is of correct size and in the proper position, the face of the patient anæsthetized by intratracheal insufflation will be of a pink color with the veins of the forehead slightly prominent. The pulse is full, bounding, and regular.⁴

When the insufflation is begun, it often happens that the patient has a short attack of spasmodic coughing. Sometimes this seems to be due to the fact that the end of the intratracheal tube is too near the bifurcation of the trachea, and the cough will cease at once when the tube is withdrawn one or two centimetres. After a few moments, however, the coughing will cease of itself.

It is possible to keep a patient under primary anæsthesia for a long period of time, if the proper percentage of ether is given with the air. Several of the patients in whom abdominal operations were in progress had sensitive corneas, would

⁴If the patient is cyanosed, it means either that the tube is not far enough in the trachea, or that too large a tube has been introduced. By the selection of the proper size of tube and its correct introduction both these accidents can be avoided.

open and close their eyes when ordered to do so, but remained perfectly relaxed and gave no evidence of pain sensation. These patients were almost fully awake as soon as the insufflation was stopped and the intratracheal tube removed.

There is an entire absence of mucus rattling in the throat during the entire period of the insufflation.

Most of the patients awaken very quickly when the insufflation is stopped; in a number of instances they would answer questions before they had been removed from the operating room. We have been accustomed to insufflate pure air for a few minutes at the end of the anæsthesia so as to blow out the anæsthetic from the lungs and trachea. So quickly, indeed, will the patient begin to react that one must be careful that the patient is receiving enough ether mixed with the air during the operation, otherwise he will begin to react before the operative manipulations are completed.

When the intratracheal tube is removed, there is often a very short period of apnœa, then regular deep breathing again begins.

I have carefully watched the patients when they have awakened from the anæsthesia. None of them had any cough or expectoration at any time, and none had any pulmonary complication of even the mildest kind after the operation.⁵ As soon as the patients were awake, they spoke freely, were not hoarse, and did not complain of any pain in their throats. I have asked every one of them whether they had any feeling of discomfort in the region of their larynx, and have thus far received a uniform answer in the negative. Further data (with perhaps laryngological examinations) will have to be gathered in the future.

There is one other feature of the post-operative course which can receive only preliminary mention here. We have observed that post-operative vomiting was conspicuously absent in our patients. The total number of anæsthesias given

⁵ This does not, of course, apply to the patients who were operated upon for pulmonary abscess or who had a pulmonary lesion before the operation.

is far too small to allow of any definite statements in this regard, and I should not have mentioned this fact at all, if my attention had not been especially called to it by the nurses and the house staff who had charge of the patients.

We have thus far anæsthetized about 30 patients by intratracheal insufflation. Some of them were operated upon for intrathoracic disease, many for abdominal or other affections. As soon as we had convinced ourselves of the safety of the method we felt justified in using it on any patients who had to be anæsthetized, and we have thus collected valuable data as to the method, the technic of intubation, etc. We have found the anæsthesia very useful in operations on the head and neck, as the anæsthetist was never in the operative field or in the way of the operator or his assistants.

INTUSSUSCEPTION, WITH SPECIAL REFERENCE TO ADULTS.*

BY ELLSWORTH ELIOT, JR., M.D.,

OF NEW YORK,
Surgeon to the Presbyterian Hospital,

AND

JAMES A. CORSCADEN, M.D.,

Assistant Surgeon to the Out-Patient Department.

THE discussion of changes in peristaltic activity leading to the development of intussusception and the results of observation in physiological laboratories of a symmetrical stimulation of different segments of the intestinal tract have been so fully presented by different writers that further consideration of that part of the subject is unnecessary.

While intussusception in infants and children is carefully and exhaustively described in both text-book and in the current literature, the consideration of the same lesion in adults is almost universally neglected. That intussusception in adults is uncommon cannot be denied, but the fact that it is sufficiently frequent to warrant careful consideration is amply proved by an analysis of the cases admitted to the service of any general hospital in a stated period of time, such as 20 or 25 years. Such a tabulated list of 115 cases from the records of St. Thomas's Hospital in London, from 1875 to 1900, was published by Pitts in the *Brit. Med. Journal* (1901, 2, page 574), and of these about 10 per cent. occurred in adults over fifteen. In a similar series of 59 cases observed in the *Scot. Med. and Surg. Journal*, 1906, xix, during a period of 10 years prior to 1905, reported by McGregor, four were in adults over twenty-one. Codman, in the *Boston Med. and Surg. Journal* for 1908, 158, pages 439-446, states that of 27 cases of intussusception in the Massachusetts General Hospital dur-

* Read before the New York Surgical Society, October 26, 1910; read before the Western Surgical Society, December 20, 1910.

ing the ten years prior to 1908, nine occurred in adults. In this connection the older statistics of Leichtenstern (*Prag. Monat.*, 1874), based upon the study of more than 500 cases and showing a percentage of 45 in adults, must be discarded, for they were evidently gathered from current literature at a time when intussusception in infants was frequently unrecognized or discovered only at autopsy, and similarly the statistics of Gibson published in the *Med. Record* for 1897, in which of 239 cases, 60 occurred in adults over seventeen, are of comparatively little value in demonstrating the relative frequency of intussusception in adults and children.

Of very considerable interest is a comparison of what may be termed the exciting causes in children and in adults. In the former the different kinds of acute intestinal disturbance resulting from improper food preponderate. In infants any inflammation or other pathological change in the vermiform appendix contributes very slightly if at all to the development of intussusception. In young children, however, the writer has collected 18 instances between the years of two and seven in which an inverted appendix was probably the cause of a cæcal intussusception, while only three instances of the same condition could be found in adults.

Trauma is frequently mentioned as a possible cause of intussusception. In infants it obtains only in the sense that the muscular effort of crying and straining unquestionably increases a pre-existing intussusception, and may even be considered responsible for its initial formation. In adults, on the other hand, trauma is infrequent, and even when mentioned as a cause may, by some, be regarded as a mere coincidence. Moreover, it is not always received in the same way. Usually a history of some sudden excessive exertion, as in heavy lifting, is said to have directly preceded the onset of the acute obstruction, while less frequently the intussusception is ascribed to a blow on some part of the anterior abdominal wall. In Case 163, that of an actor in vaudeville, the patient had daily held a number of men on the rigid abdomen. After one of these performances, acute obstruction developed, and

operation disclosed an intussusception due to an inverted Meckel's diverticulum with a subserous lipoma at its apex, an unusual combination of three so-called exciting causes. A lateral anastomosis after resection was done, and on recovery the patient was advised to change his occupation. In a number of instances such as the preceding, trauma might be regarded as a contributing cause, for either benign neoplasm or a Meckel's diverticulum might alone be responsible for an intussusception. This interpretation must obtain in Case 49, in which after a fall on the left side a subserous lipoma was found at the apex of an intussusception. In the three following cases, however, no cause was found either at operation or at autopsy, and the previous history of trauma assumes a correspondingly greater importance. In Case 25 wrestling had preceded an intussusception, which terminated fatally from peritonitis after the discharge of a necrotic intussusceptum from the bowel. A similar case, No. 37, may be cited, in which a slough composed of the transverse colon was discharged from the bowel after an obstruction of a week's duration, preceded by a history of lifting a heavy weight. In Case 193, an enteric intussusception, a history of playing football is mentioned. An analysis of the 300 cases cited in this paper gives 23 instances in which some form of trauma was associated with the intussusception, and a glance at Table I shows that, of all the different forms of trauma, that one in which there is some form of violent muscular exertion is by far the most frequent.

TABLE I.

Trauma, not classified	2
Blow	2
Crush	1
Fall	3
Violent muscular movement, football (1), riding (2)....	7
Lifting heavy weight	7
Puerperium	1
Typhoid	5
Dysentery	6
Tuberculosis	5
Simple inflammatory ulcers	3

Tumors of the intestine are a comparatively frequent cause of intussusception in adults, occurring rarely in infants and children. Of the 300 cases here cited, there were 60 instances of benign tumor and 40 instances of the malignant type. Of the former class, the majority had their origin in the inner layers of the intestinal wall, usually by a constricted or pedunculated base, and projected into the lumen, forming by that means a more natural form of irritation than the less frequent growths which were subserous and projected toward the peritoneal cavity. Histologically, polyp, lipoma, myo-adenoma, fibroma, myxofibroma, myofibroma, myxoma, cyst of the ileocæcal valve, and papilloma are all mentioned, the polyp being the most frequent and occasionally multiple. In four instances the benign tumor was associated with a Meckel's diverticulum: in Case 152, a fibrous polyp at its apex; in Case 151 a similar growth in its interior; in Case 163, a subserous lipoma at its apex, and in Case 97 a plum-sized fibrous tumor near its base. In almost every instance, the tumor occupied the apex of the invagination, but in Case 96 it was at its base, a situation in which the question of its being an exciting cause might well be open to argument.

The malignant growths include different varieties of carcinoma, sarcoma, myxosarcoma, melanotic epithelioma, and in Case 111 a sessile polyp in the sigmoid which had become malignant. The location of the growth may be studied in Table II. No part of the alimentary tract seems to be immune, but as is the case with growths of the intestine independent of intussusception, benign varieties are more frequent in the small, while malignant growths more frequently invade the large intestine. Moreover, attention may be directed to the fact that intussusceptions occurring in connection with benign growths in the large intestine are situated in either the sigmoid or rectum.

Ulceration of the intestine other than that associated with malignant growths is a well-recognized cause of intussusception in adults. Ulceration associated with typhoid fever, dysentery, tuberculosis, and simple ulcers possibly of sterco-

raceous origin preponderate. The writer has reported in vol. xxiv of the *Transactions of the American Surgical Society* a case of enteric intussusception associated with the convalescent period of typhoid fever in a young girl of seven. A study of the 300 adult cases here reported shows 5 instances of intussusception due to typhoid ulceration, 6 instances of intussusception in connection with dysenteric ulcers, 5 instances of intussusception associated with tuberculosis, and at least 3 instances of intussusception associated with what are described as simple inflammatory ulcers. In intussusception due to tuberculosis, the lesion may be a tuberculous infiltration of the serosa or subserosa of the intestine without ulceration of its mucous membrane.

TABLE II.

	Benign.	Malignant.
Enteric, not stated	4	3
Duodenum	0	1
Upper jejunum	1	0
Lower jejunum	0	0
Not stated, jejunum	4	2
Upper ileum	0	1
Lower ileum	5	1
Not stated, ileum	5	2
	—	—
Total	19	10
Ileocæcal valve	13	9
	—	—
Total	13	9
Colon, not stated	5	2
Ascending colon	0	1
Transverse colon	0	0
Descending colon	2	0
Sigmoid	6	5
Rectum	1	1
Cæcum	3	9
	—	—
Total	17	18

Meckel's diverticulum is associated with intussusception in both adults and children. In 29 cases of this particular variety, 15 occurred in patients under ten, five between 10 and

20, four between 20 and 30, and four in patients between 30 and 49, and in one the age is not given. In the different varieties of acute obstruction directly due to this appendage without intussusception, a similar age relationship obtains and cases occur even as late as in the sixth decade. The exact nature of the irritation which brings about the initial inversion of a diverticulum in intussusception is rather difficult of explanation. Reference has already been made to the occasional presence of a polyp or other benign growth in this connection. In the majority of cases, however, in irritation or inflammation from inadequate drainage of its secretion lies the probable explanation of this unusual lesion.

Foreign bodies within the alimentary canal, impacted or free, rarely cause intussusception. In Case 33, however, a rusty darning needle and in Case 180 a date stone may have been contributing factors.

Some writers believe that intussusception may be due to the irritation of intestinal parasites such as ascarides or lumbricoides. Whether the presence of such parasites is a mere coincidence or an actual contributing cause is largely conjectural.

Attention is directed to a considerable number of acute, subacute, or chronic cases of intussusception in which no cause is mentioned. That cases occur without discoverable cause must be admitted. On the other hand the lack of mention of a cause is not infrequently due to omissions in the published report of the case.

The uniformity of the clinical picture of intussusception in infants and young children has been emphasized by Clubbe, Codman, and many other writers. In this group of cases the symptoms, both local and constitutional, are so characteristic that a correct diagnosis should be promptly made. On the other hand, that the clinical picture of intussusception in adults varies widely is well illustrated in the histories of the following cases in both of which the cause was a polyp attached to the intestinal wall by a constricted base. As a matter of fact the great contrast presented by these histories suggested

to the writer the desirability of investigating the subject of acute intussusception of adults as a whole, with the object of arranging if possible the different groups into which, in accordance with their varied courses, the cases might justifiably be divided.

CASE I.—Male, aged forty. Referred by Dr. Ferguson.

Ever since childhood and until a short time ago patient has suffered from occasional abdominal cramps; three or four months ago patient was seized by slight cramp-like pains in the left lower quadrant occurring either before or after eating. They were of from 10 to 15 minutes in duration and were relieved by simple measures. Twenty-nine hours ago, patient was seized by a sudden, severe, cramp-like pain in the left lower quadrant, which did not radiate. Shortly after the onset the bowels moved spontaneously, the movement consisting of blackish material. At the same time vomiting occurred and has been repeated at frequent intervals up to the time of admission into the hospital. About eight hours after the invasion, patient felt a hard lump in the right lower quadrant, which shortly afterward moved to the left side. The tumor and its change in position was confirmed by the family physician. In addition there was a history of the frequent passage of mucus and blood from the rectum.

Physical examination on admission to the hospital showed that the abdomen moved with respiration. There was a localized distention in the midumbilical region extending more to the right than to the left side. On palpation, two loops of elastic distended intestine, separated by a groove, could be distinctly felt in the distended area. These loops were movable from side to side and tympanitic on percussion. The overlying abdominal wall was moderately rigid. There was slight dulness in the flanks half way up to the navel. There was no evidence of increased or focal peristalsis. Apart from the presence of blood and mucus in an enema, examination of the rectum was negative. The temperature was 100°, the pulse 92, and respiration 22. The general condition appeared excellent.

Under anæsthesia, an incision was made along the outer border of the right rectus muscle, and on opening the peritoneal cavity a small amount of serous fluid issued from the wound. The distended loops above mentioned proved to be those of an

enteric intussusception, which was about 12 inches long and curved like an enormous sausage upon its mesenteric axis. It was completely irreducible. A resection of what proved to be about four feet of small intestine was then carried out, and the divided ends united by circular suture. The abdomen was closed without drainage. The patient reacted well from the operation and recovered without complication. An examination of the intussusception showed a polyp about the size of an English walnut at the apex of the invagination. The intussusciens was in a condition of incipient gangrene and the mesenteric veins were thrombosed.

CASE II.—Female, aged sixty-seven. Referred by Dr. Niesley.

Patient has always enjoyed excellent health until four months ago, when she suffered from several attacks of epigastric pain and vomiting. These quickly subsided, and patient was quite well until several weeks before her admission into the Nassau Hospital, when the epigastric pain recurred and, on abdominal palpation, a mass was found occupying the position of the transverse colon. This mass was doughy, insensitive, and, owing to a long pre-existing constipation, was supposed to be due to a possible fecal impaction. A high enema was given and the mass almost totally disappeared, only a small portion remaining in the right lower quadrant. At the same time the enema brought away only a small amount of ordinary fecal material. From time to time recurrence of the tumor took place, always without pain and without discomfort to the patient, only to disappear with an enema or after abdominal massage. At no time was there even subacute obstruction and operation was delayed merely with the idea of improving the patient's general condition. Rectal examination was negative.

Under ether the peritoneal cavity was opened by a right pararectal incision and the intussusception exposed. It was of the ileocolic variety and extended as far as the splenic flexure. Disinvagination was quickly accomplished until the cæcum was reached, and with a little pressure something was felt to slip through the ileocæcal valve and for a distance of six inches above it. From this point the intussusception, about six inches in length, was totally irreducible and was resected, followed by end-to-end suture. After the removal of the appendix, which was

oedematous and thickened, the abdomen was closed without drainage, the patient making an excellent recovery. Examination of the specimen removed showed a polyp the size of a lemon and attached by a constricted base to the apex of the invagination.

Through the courtesy of the gentlemen mentioned below I am permitted to present notes of five more hitherto unpublished cases.

CASES OF DR. JOHN GIBBON, Philadelphia, Pa.

CASE III.—A male, aged fifty-eight, was operated upon in the Presbyterian Hospital July 27, 1900, after a history indicating intestinal obstruction. He was in bad condition when operated upon. Eight to ten inches of the ileum had passed into cæcum and could be withdrawn. Three feet eleven inches of ileum were resected to get above gangrenous portion. The end of small bowel and cæcum opening were sutured in the wound. Drainage. Death on the same day.

CASE IV.—A male, aged nineteen, previously in good health, his bowels having moved twice that morning, was seized by sudden severe abdominal pain and vomiting. The pain gradually became worse and several hours later he consulted Dr. Graham, who gave him a hypodermic and could distinguish a mass in the right lower quadrant when the boy became quiet. Seen by Dr. Gibbon shortly afterward, at Dr. Graham's office, patient was pale and without pain. Temperature was subnormal, abdomen was scaphoid and a little rigid. In the right lower quadrant was a distinct, oblong, slightly tender and movable mass. One hour later temperature was subnormal and mass was thought to have changed somewhat. Operation was refused until next day. Enemata had been ineffectual, and vomiting had occurred several times. There had been no tenesmus or rectal bleeding.

Operation 24 hours after onset. Under ether anæsthesia examination showed that mass had moved further up on right side. Through incision, through right rectus sheath, presented a large intussusception. Reduction was impossible. Incision made through ant. long. band of colon, which was filled with bloody exudate and 18 inches of ileum. It was impossible to draw ileum further into lumen of large bowel for purposes of resection. The contained ileum was tied off inside colon near

ileocolic junction, and two rows of sutures applied outside to prevent leakage. Lateral anastomosis between ileum and colon was made, utilizing the slit in the colon. Catgut was used for all inner rows of sutures and linen on the outside. Bowel was washed with saline and iodoform drainage was inserted.

Post-operation, a small quantity of flatus and bloody fecal matter was passed. There was a short post-operative rise of temperature. Feeding was begun immediately and convalescence was uninterrupted.

Cases of DR. W. J. MAYO, Rochester, Minn.

CASE V.—In an adult having colicky symptoms for several months. There was an adenofibroma in the ileum.

CASE VI.—Age fourteen, with no previous symptoms; there was a myoma 6 inches above ileum into cæcum and ascending colon. Both cases recovered after resection.

Case of DR. JAMES E. MOORE, Minneapolis, Minn.

CASE VII.—Age twenty-five, had repeated attacks of colic through several years, diagnosed appendicitis. Present attack 24 hours. Variety, ileum into colon about 18 inches. Condition, dark color of both outer and inner coats but no gangrene. Operation, reduction and resection of a Meckel's diverticulum. Result, prompt cure. Patient had one attack of colic after the operation.

Returning to the above-mentioned classification, we find that Table A, including cases of intussusception associated with benign tumors, is the largest, comprising one-fifth of all cases here tabulated, and may be divided into four groups as follows:

(a) Those in which, as in the first case reported, the onset of the obstruction is acute and without warning, the patient having previously enjoyed perfect health.

(b) Those in which the acute onset is preceded by a history of previous attacks of obstruction relieved without operation, or a history of chronic constipation, indigestion, or of both extending over many years, or a history of intermittent attacks of colic with or without vomiting, concurrent with constipation and separated by intervals of complete freedom from all abdominal discomfort.

(c) An infrequent group in which the intussusception is essentially chronic, without marked pain, with no vomiting, and with only moderate constipation easily relieved by enema. The second patient herewith reported belongs to this group.

(d) An occasional group comprises those patients who give a history simulating some other abdominal lesion, in whom the intussusception is discovered only in the course of an exploratory laparotomy. Thus, in Case 80, symptoms of three years' duration pointed either to cholelithiasis or peptic ulcer, yet on operation an enteric intussusception with a polyp at its apex was discovered and removed.

Of the patients suffering from this form of intussusception, the youngest was fifteen with the exception of Case 52, a male of four reported by Brunner, in which the cause of the intussusception is given, "as an accessory pancreas in the blind end of a diverticulum forming a pedunculated tumor in the lower ileum." The oldest occurred in a patient of eighty-four and it is worthy of note that in four patients over seventy, three polyps presented in the rectum and the fourth in the descending colon.

The fragmentary way in which a number of these cases are reported renders useless the computation of any percentages of individual symptoms, such as abdominal tumor, the frequency of rectal discharges of blood and mucus, the absence of constipation, the frequency of vomiting, etc. In 22 cases the presence of an abdominal tumor is mentioned; in one no tumor could be detected. In the remainder no statement regarding the presence or absence of a tumor is made. In 15 cases note is made of the discharge of either blood or mucus; of the remainder only in one is it mentioned that rectal examination was negative. It is worthy of note in this connection that in at least two cases, Nos. 52 and 67, the discharge of blood from the rectum was sufficiently abundant to constitute actual hemorrhage. Attention should also be directed to the occasional mention of rectal tenesmus. This symptom is evidently most frequently associated with benign growths below the level of the splenic flexure.

Table B includes 40 cases of intussusception with malignant tumor, which may be conveniently divided into the following groups:

(a) Those in which the onset is acute, occurring without warning in patients who have always enjoyed excellent health. Such cases are uncommon; Case 141, an enteric intussusception due to multiple sarcoma with mesenteric glandular involvement, may be cited as an example. In Case 119, symptoms of acute appendicitis were followed after ten days by those of subacute obstruction in what proved to be an intussusception associated with a sarcoma of the ileum.

(b) In this group the development of the intussusception is preceded by a history of a primary growth, usually sarcoma, in some distant part of the body.

(c) By far the most frequent are cases belonging to this group, in which the symptoms pointing to an intussusception are preceded by those due to malignant stricture. In cases of this character the obstruction due to the intussusception is essentially chronic, and in its later stages cannot easily be distinguished from the terminal obstruction so frequently seen in malignant stricture of the large intestine. The alternating constipation and diarrhœa, the blood and at times pus in the stool, the presence of focal distention and of visible peristalsis, together with the recurrent attacks of subacute obstruction, relieved by enemata, are all classic symptoms of that condition. It is only by the discovery of the characteristic tumor that the diagnosis of intussusception can be made, and even then the diagnosis may be erroneous, since the tumor may be due to a temporary fecal impaction on the proximal side of the stricture.

Table C comprises those cases of acute intussusception either without discoverable cause or at least without the mention of any cause in the history. They may be conveniently divided into two groups:

(a) Cases with acute onset, without warning, in patients previously healthy.

(b) Cases with acute onset, preceded by a history, ex-

tending over weeks or months, of some abdominal disturbance. Of this group Case 213 may be cited, in which the patient suffered from intermittent attacks of sharp colicky pain for six months prior to operation for an irreducible enteric intussusception, three feet below the pylorus. The patient, a woman of fifty, died shortly after the resection of the invagination and the suturing of both ends of the divided intestine into the abdominal wound. Case 218 is also of interest. The patient, a male of twenty-two, gave a history of three attacks of acute cramps of short duration, with the formation of a tumor occurring within the three weeks prior to the operation. On each day there was diarrhœa, and at operation an ileo-cæcal invagination extending to the splenic flexure was found. The patient made an excellent recovery after resection followed by end-to-end suture.

Table D comprises those cases of acute intussusception, exclusive of tumors, in which some other specific cause was found. They may conveniently be divided into two groups:

(a) Those with an acute onset preceded only by the symptoms of the actual exciting cause.

(b) Those in which the acute onset is preceded by a history of some abdominal disturbance. Of this type Case 190, in which the patient suffered from two attacks of abdominal pain 16 years and 10 weeks prior to the invasion of the intussusception, seems to be the only example. At operation an intussusception was found with a well-defined ulcer at its apex. On the other hand, Group *a* includes cases following various kinds of trauma (which have already been discussed under the etiology), cases occurring in connection with typhoid fever (one on the twenty-fifth, two on the twenty-sixth, one on the fortieth day, and one during convalescence), and a case associated with colitis.

Table E comprises those cases of subacute and chronic intussusception for which no cause is mentioned in the history. In nearly all the cases of this group of which the history is not fragmentary, there is a story of intermittent attacks of colic, with the appearance of a tumor or of a distended loop

of intestine, which in many instances are noted by the patients themselves.

Table F comprises cases of subacute or chronic intussusception, in the histories of which a distinct cause is mentioned, and may conveniently be divided into two groups:

(a) Those in which the actual cause is recognized prior to the operation, including cases of chronic intussusception associated with dysentery or persistent typhoid or tubercular ulceration. In this group the symptoms and physical signs of intussusception modify those which are due to the pre-existing lesion.

(b) Those in which the actual cause is revealed only by the operation or autopsy. This group includes cases of chronic intussusception associated with subserous tubercular infiltration of the intestine, as well as those due to chronic ulceration of the cæcum or colon which is probably of stercoraceous origin. In this group the history does not differ materially from the history of a case of chronic or subacute intussusception in which the actual cause can never be ascertained.

Table G includes all cases of intussusception, irrespective of the age of the patient, due to Meckel's diverticulum. These may conveniently be divided into two groups:

(a) Those in which the invasion is acute without previous history of abdominal trouble.

(b) Those in which the invasion of the terminal obstruction is preceded either by one or more attacks of obstruction which have subsided spontaneously, or by some other minor abdominal or digestive disturbance. Thus in Case 170, in a woman aged thirty-nine, there was a history of attacks of subacute obstruction occurring several times in the course of each year for a period of 12 years. In Case 162, on the other hand, there was merely a history of poor digestion with occasional colic, and in Case 145 a history of sudden unexplained hemorrhage from the bowel one month before the symptoms of acute obstruction appeared.

Considerable variation is also observed in the individual symptoms of the acute terminal obstruction in intussusception

due to Meckel's diverticulum. While complete constipation is the rule, either the passage of one or more normal stools or actual diarrhœa is not an infrequent exception. Blood and mucous discharges from the bowel are mentioned in six cases, once with tenesmus. In four instances it is stated that neither blood nor mucus was discharged from the rectum, and in the remaining 13 cases no mention is made of this symptom. The presence of a tumor was almost always observed.

The clinical course is usually exceptionally severe. In fact analysis of the cases of this lesion shows that the inverted Meckel's diverticulum is, with but two exceptions, irreducible, and that gangrene of the intussusception occurs so promptly that early operative interference is urgently demanded.

In all the different forms of intussusception, both acute and chronic, and irrespective of the actual contributing or exciting cause, the presence of an abdominal tumor and its variation in size, position, and consistency, either during or independent of the attacks of colicky pain, are especially characteristic. The clinical picture of a tumor quickly appearing or increasing in size during the attacks of colic, and disappearing or decreasing in size with their cessation, renders the diagnosis of intussusception certain. The writer has referred in a previous paper to the fact that the overlapping of the spleen or liver may conceal an intussusception at the hepatic or splenic flexures of the colon, and also to the fact that an intussusception gravitating or moving into the depths of the pelvis may be especially difficult to palpate. The possibility of such contingencies emphasizes the importance of making a bimanual examination in either ileocostal space as well as through the rectum, by means of which, either with or without the assistance of an anæsthetic, the tumor mass may usually be detected. The writer wishes also to emphasize the increase in the consistency of the mass formed by the intussusception, either with the advent of a cramp or even as the result of the mechanical stimulation in the course of routine palpation. This change in consistency, although it does not always occur, differentiates the tumor of an intussusception from either a neoplasm or a fecal impaction.

The presence of an abdominal tumor, together with the similarity of the symptoms of the two conditions, accounts for the occasional confusion of intussusception with appendicitis. A correct diagnosis is usually possible by noting that the tumor associated with appendicitis is almost invariably fixed and enjoys little if any respiratory movement. Moreover, the associated muscular rigidity is of great importance. In appendicitis it is almost always most marked in the lower right quadrant, while in intussusception the symptom, if present, is generally more marked to one side or the other of the umbilicus, while the intervening abdomen between this area and either inguinal region is either less rigid or entirely free from any rigidity whatever. This proved to be the fact in the first case reported in this paper. Both iliac and both hypochondriac regions were free from rigidity, and although the enteric intussusception was of 28 hours' duration, the abdominal wall over the large tumor was not sufficiently rigid to interfere with its satisfactory palpation.

The course of acute intussusception in adults is more prolonged than in infants or children. The latter quickly succumb to the intestinal toxæmia, the result of obstruction, before the advent of peritonitis. In adults, on the other hand, the course may be so protracted that, the intussusciptum remaining viable, the obstruction may be relieved by the spontaneous discharge of the necrotic intussusceptum through the rectum. Of the 43 cases of this character included in Table H only three occurred in patients less than four years old. The remainder include cases of intussusception associated with Meckel's diverticulum, with benign tumors, and many others in which the actual cause could not be recognized in the discharged slough.

It is self-evident that, owing to the primary risk, the possibility of relief through the discharge of the necrotic intussusceptum should not encourage conservative measures in the treatment of this condition, and it is emphasized by Raven, as well as shown by a study of the end results in the additional cases reported in Table H that, although temporary relief is usually afforded by nature's method, yet within 18 months and usually much earlier, secondary obstruction develops from cica-

tricial contraction at the point of the original invagination and is rapidly fatal. Such an unfortunate termination appears so common that, after the subsidence of the abdominal symptoms associated with the discharge of the slough in these neglected cases, the writer suggests the advisability of providing against the contingency of subsequent obstruction by establishing a lateral anastomosis between the intestinal canal on either side of the site of the invagination.

The principles which govern the treatment of intussusception in adults do not differ essentially from those in children. The fallacy of palliative measures is just as pronounced in the one as the other, although, owing to their greater resistance, the risk incurred by delay in adults is not as great as in children. It must be admitted that in both a temporary if not a permanent reduction is sometimes effected by rectal injections of either air or water. On the other hand, at the expense of possible repetition, it must be emphasized that experience has amply demonstrated that the disappearance of the tumor as a result of either of these measures of treatment may mean but partial disinvagination and that, after a brief respite, the symptoms of acute obstruction may recur with renewed virulence, the tumor being again palpable through the abdominal wall or rectum, and the general condition of the patient, especially in an infant, less capable of overcoming the shock of inevitable operation.

The earlier the operation in infants the easier and the more quickly accomplished is the disinvagination, and if this takes place within the first 12 or even 24 hours after the onset of obstruction, the total operative time should not exceed from 10 to 15 minutes. Under such favorable conditions the chances of recovery, even in a young infant, are excellent.

With the exposure of the intussusception, disinvagination is to be accomplished by a combination of expression and traction. In the paper already referred to, the writer has called attention to the danger of rupture of the intestine if dependence is placed upon either of these measures alone. Usually in the first stages of reduction, expression only is necessary. In the last part of reduction, however, in which the greatest difficulty

is experienced, a combination of both measures is indicated. With the completion of reduction when that has proved feasible, the cause of the intussusception is to be removed if possible; thus a Meckel's diverticulum or an appendix may be resected, while a benign tumor may be removed through a linear incision of the intestinal wall or even, as is always the case with a malignant growth, by complete resection. The cause having been removed, a recurrence of the intussusception is best prevented by anchoring the affected loop to the lateral parietal peritoneum. This method is more reliable and can be more quickly accomplished than the reefing of the mesentery, than the more radical measure of resection of the affected loop, or the ingenious reefing of the large intestine suggested by Passagi (Case 292), in which two parallel rows of Lembert sutures are placed on either side of its anterior longitudinal band (endoplication of the cæcum).

TABLE III.

	No.	Cured.	Died.	Not stated.
Resection	84	41	34	9
Splitting sheath and resecting intussusceptum from within	9	7	2	
Partial reduction followed by resection	18	11	5	2
Reduction complete, resection of tumor or Meckel's diverticulum	17	6	7	4
Reduction complete, resection for stricture or to prevent recurrence	2	1	1	
Reduction	37	23	7	7
Bimanual reduction (one hand in bowel)	2	2		
Attempted reduction, tear, resection	10	3	7	
Ileocolostomy, entero-enterostomy	13	5	6	2
Enterostomy	4	1	3	
Enterotomy	1	1		
Resection and removal rectally...	5	3		2
Incision of constricting band, reduction	3	2	1	
Artificial anus	12	1	8	3
	—	—	—	—
	217	107	81	29

The treatment of irreducible or gangrenous intussusception depends upon the condition of the intussusciens and the intussusceptum. If both are necrotic, resection is imperative. In infants of less than a year, such a drastic measure is usually fatal but is without alternative. The subsequent continuity of the intestine must be established in the quickest possible way, for a temporary enterostomy rarely improves the infant's condition. In adults, on the other hand, a temporary enterostomy is frequently of great advantage, if not situated too near the pylorus, the subsequent anastomosis being done after the symptoms of the acute obstruction have subsided.

If the intussusciens is viable, the removal of the intussusceptum has been accomplished with considerable success through a linear incision in its wall. Reference to Table III shows nine such operations with seven recoveries and two deaths. The relatively low mortality may be partially accounted for by the fact that all nine cases were reported during the past ten years, and that with two exceptions the intussusception was either of the subacute or chronic variety.

The viability of the intussusciens also permits of intussusception being treated by enterostomy or by ileocolostomy. If the intussusceptum is necrotic, the slough is eventually discharged through the bowel. If, as is the case with many subacute or chronic intussusceptions, the intussusceptum is viable, an ileocolostomy relieves the obstruction, and by deflection of the fecal current exerts a beneficial effect upon any benign ulceration that may have been responsible for the intussusception. In such cases secondary resection should follow as soon as the patient's condition permits. Reference to Table III shows 13 operations of this character with five recoveries and six deaths. In the two remaining cases the result is not mentioned.

Of greater value than either of the preceding methods is the treatment of irreducible intussusception in adults by resection. This is the method of choice in all suitable cases in which attempted reduction, carried on for a few minutes, is unsuccessful. How often too energetic or too persistent at-

tempts at reduction result in tearing the intestine need not be stated, but it is quite evident that the results of resection are most satisfactory in the absence of any such additional source of contamination, and that any leakage subsequent to anastomosis is less likely to occur if the intestine is divided at a point where it is free from inflammatory changes. Such a resection must invariably be preceded by as much disinvagination as can easily and quickly be accomplished. Exceptionally, as in the first case reported by the writer, the intussusception is totally irreducible. Usually, however, reduction is possible to such an extent that subsequent resection is limited to a segment of intestine not exceeding 6 to 18 inches in length. After the removal of the affected segment, the risk of intestinal toxæmia should be diminished by evacuating the contents of the intestine above the point of suggested anastomosis. Frequently, however, if the operation is done sufficiently early, the upper intestine is empty and this step of the operation may be omitted. Reference to Table III shows 84 cases treated by resection, with 41 recoveries, 34 deaths, and 9 cases in which the result is not stated. It must be noted, however, that the majority of fatal cases were reported in the literature at a time when the technic of resection had not been perfected and when the operation itself was frequently delayed until peritonitis had developed.

The discussion of the treatment of intussusception in adults is not complete without referring to a series of 19 cases mentioned in Table III which were treated by the method of complete reduction followed by resection with 7 recoveries, 8 deaths, and 4 cases in which the result is not stated. This method seems to have been adopted chiefly in cases of intussusception associated with tumors. In this group of cases partial disinvagination is usually possible until the segment containing the tumor is reached. At this stage, the removal of the growth by enterotomy is sometimes possible, but in all malignant tumors as well as in those benign tumors in which the wall of the intestine is extensively involved, resection is imperative. Resection after reduction in other varieties of intussusception

than those associated with neoplasms is contraindicated, for it means, first, the unnecessary prolonging of the operative time and, second, in the event of a gangrenous intussusceptum, the exposure of the patient to unnecessary risk of peritoneal contamination.

Table III also mentions five cases in which the growth was removed through the rectum, with three recoveries and two cases in which the result is not stated. Although the small number of cases admits of no definite conclusion, the satisfactory results here reported would indicate the application of this method of treatment to all forms of benign neoplasm associated with intussusception in the lower part of the intestinal canal where the tumor presents in the rectum. In some cases of this group the removal of the growth must be followed by immediate laparotomy to establish the continuity of the colon, as well as to prevent leakage into the peritoneal cavity.

Finally, reference to Table III shows four cases of intussusception treated by enterostomy with three deaths and one recovery, and 12 cases in which an artificial anus was established, with one recovery, eight deaths, and three cases in which the result is not stated. Either measure is purely palliative, and it is scarcely necessary to call attention to the fact that the obstruction rather than the operation was the actual cause of the associated high mortality. That relief is frequently afforded by this method of treatment in all forms of both acute and chronic obstruction in which there is no impairment of circulation is well established. On the other hand, it is equally true that no benefit can be expected if gangrene is threatened or has actually taken place.

In the cases given below, a tabulation of the following factors was made: sex; age; prior history; onset, whether acute or chronic, together with its symptoms; the condition of the bowels; objective signs in rectum: blood, mucus, etc.; abdominal signs: tumor, distention, rigidity, etc.; the operation if any, the variety of intussusception, the result and any remarks on pathology, end results, etc.

ABSTRACTS OF REPORTED CASES OF INTUSSUSCEPTION IN ADULTS.

TABLE A.

Due to Traction of Benign Tumors.

Case 44 (Bryant, *Brit. Med. Jour.*, 1894, i, p. 353).—Female, age 84. Operation: Intussusception filling rectum with papilloma attached to orifice. Growth drawn down; ligated. Recovered.

Case 45 (*Ibid.*).—Female, age 50. Similar to Case 44.

Case 46 (Lockwood, *Path. Rep.*, London, 1892).—Female, age 30. Operation: Irreducible invagination; resection; suture end-to-end. Variety: Enteric, 5 inches long. Pathological remarks: Polyp pedunculated $2\frac{1}{2}$ feet from cæcum.

Case 47 (Steiner, *Cent. f. Ch.*, 1896, p. 310).—Female, age 49. Prior history: Frequent attacks of obstruction. Onset: Complete obstruction. Operation: Enterotomy; removal of polyp size of plum. Position: Colon, descending. Recovered. Pathological remarks: Myxoma.

Case 48 (Greig Smith, *Lancet*, 1896, i, p. 31).—Female, age 31. Prior history: Complete obstruction two years ago with mass in right iliac fossa. Onset: Lately intermittent frequent pain, with constipation. Operation: Partial reduction; resection of remainder, after removal of tumor size of hen's egg; end-to-end with Murphy button. Variety: Iliac into colon. Recovered. Pathological remarks: Fibromyxoma.

Case 49 (Marchand, *Berl. klin. Woch.*, 1896, No. 6).—Male, age 23. Prior history of trauma: Fall on left side, next day dancing. Onset: Acute, pain and vomiting, symptoms of obstruction. Operation: Fifth day; enterostomy for supposed obstruction. Ileocolic into descending colon. Died. Pathological remarks: Subserous lipoma of cæcum.

Case 50 (Sprengel, *Archives Surg.*, Bd. 61, p. 1032).—Female, age 15. Prior history: Periodic attacks of pain with vomiting for eleven years. Onset: Painful period for month. Bowels: Stools always present. Thick transverse tumor above navel. Operation: Disinvagination; resection of 10 cm. large and 6 cm. small intestine; end-to-end with Murphy button. Variety: Ileocæcal. Recovered. Pathological remarks: Cyst of valvula Bauhini.

Case 51 (Brunner, C., *Beitrag*, xxv, p. 344).—Male, age 51. Onset: Six days pain. Bowels: No stool, no flatus. Rectal examination: Rectal tenesmus; tumor within sphincter. Operation: Sphincter dilated and divided posteriorly; tumor removed with invagination. Pathological remarks: Submucous lipoma.

Case 52 (*Ibid.*).—Male, age 4. Onset: Pain and vomiting three days. Bowels: One normal stool, then constipation. Rectal examination: Sharp hemorrhage. Operation: Resection with side implantation. Variety: Ileocæcal. Pathological remarks: Accessory pancreas in blind end of diverticulum had formed pedunculated tumor in lower ileum.

Case 53 (Hiller, *Beitrag*, xxiv, p. 509).—Male, age 51. Onset: Occasional pain and vomiting. Bowels: Little stool. Rectal examination: tenesmus; otherwise negative. Distention: Moderate. Operation: Reduction, tear in process; resection, end-to-end by suture. Iliac invagination. Died. Pathological remarks: Submucous lipoma.

Case 54 (Studsgaard, *Nord. Med. Arkiv.*, 1894).—Female, age 42. Operation: Irreducible; resection. Variety: Jejunal. Death in five days from peritonitis. Pathological remarks: Polyp, lipoma.

Case 55 (Castelain, *Gaz. Hebd.*, 1870, No. 20).—Male, age 43. Prior history: Habitual constipation. Onset: Loss of appetite, nausea. Bowels: Constipation. Rectal examination: Blood and mucus; tenesmus. (Case also made discharge of slough.) Fourth week, discharged large tumor, with thin pedicle. Recovered. Pathological remarks: Lipoma.

Case 56 (Vois, *Norsk. Mag. for Lagevidenl.*, 1881).—Operation: Invagination of lipoma into rectum; resection; reduction of intussusception by water injection.

Case 57 (Brohl-Tuffier, see Hiller).—Female, age 43. Prior history: Nine months constipation and pain. Tumor felt per rectum. Operation: Irreducible; artificial anus. Variety: Sigmoid. Died. Pathological remarks: Submucous pedunculated polyp in lower sigmoid.

Case 58 (Clos, *These*, Paris, 1883; see Hiller).—Female, age 45. Onset: Acute obstruction. Operation: Artificial anus. Died. Pathological remarks: Pedunculated lipoma in invaginated sigmoid.

Case 59 (Brohl, *Dissert. Würz.*, 1886).—Female, age 40. Prior history: Fifteen years abdominal pain. Onset: Past year sense of something coming down. Rectal examination: Descent of invaginated lipoma in rectum. Pathological remarks: Lipoma.

Case 60 (Treves, Leipzig, 1888).—Female, age 83. Prior history: One year indigestion, colicky pain. Bowels: Diarrhœa and constipation. Finally discharge of lipomatous polyp. Pathological remarks: Lipoma.

Case 61 (Link, *Wien. k. Woch.*, 1890, No. 13).—Male, age 45. Prior history: For five years attacks of obstruction. Tumor: Elastic, soft tumor size of man's fist in left hypochondrium for one year. Operation: Tumor evacuated with sudden gush of blood through rectum. Recovered. Pathological remarks: Tumor, pedunculated.

Case 62 (Michaux, *Bull. Soc. Chir.*, 1900, p. 734).—Female, age 23. Onset: Sudden pain and vomiting. No distention; tenderness. Operation: Fifth day; invaginated upper jejunum; irreducible; jejunum opened; resection of tumor and intestine. Died. Pathological remarks: Polyp "adenoma" was cause of irreducibility.

Case 63 (*Ibid.*).—Female, age 56. Onset: Five days obstruction. Bowels: No stools. Mass in left lower quadrant. Distention; visible coils. Operation: Irreducible; artificial anus after incision of tumor and discovery of polyp. Variety: Descending colon into sigmoid. Died. Pathological remarks: Resection of polyp.

Case 64 (Pitts, *Brit. Med. Jour.*, 1901, ii, 574).—Male, age 32. Onset: Acute, one day. Operation: Reduction; removal of growth; subsequent fecal fistula. Variety: Enteric. Died. Pathological remarks: Resection of gangrenous bowel; papilloma.

Case 65 (*Ibid.*).—Female, age 32. Prior history: Thirteen weeks' duration. No operation. Chronic ileocæcal. Pathological remarks: Fibroid growth in cæcum.

Case 66 (Maurice, *Lancet*, 1901, i, p. 248).—Female, age 23. Prior

history: Anæmic; vague abdominal pain, vomiting after eating. Onset: Sudden pain. Rigidity: General. Operation: Reduced; polyp removed; excision, circular suture. Variety: Jejunal. Died. Pathological remarks: Intussusception; segment 34 inches from pylorus gangrenous; 10 polypi between it and pylorus.

Case 67 (Jenly, *Wien. k. Woch.*, 1901, p. 1177).—Male, age 70. Onset: Four days' duration, pain. Bowels: Stool scant. Rectal examination: Hemorrhage, repeated. Prolapsing tumor, especially on coughing. Operation: Resection through anus. Variety: Colonic. Recovered. Pathological remarks: Polyp.

Case 68 (Marchand, *L'Inde. Med.*, 1901, p. 86).—Male, age 27. Prior history: Habitual constipation. Onset: Symptoms of appendicitis. Variety: Ileum into ascending colon; ileum into ileum. Pathological remarks: Polypi in ileum.

Case 69 (Bishop, *Med. Chron.*, 1900-01, p. 350).—Male, age 43. Prior history: Lifting, followed by protrusion seven months ago; occasional pain. Rectal examination: Constant mucus and blood; tenesmus; long tubular mass. Operation: Preliminary anastomosis followed by resection of intussusceptum, by Maunsell. Variety: Colonic. Recovered. Pathological remarks: Adenoma.

Case 70 (Ludloff, *Grenz. Gebiet.*, 1898, iii, p. 600).—Female, age 20. Prior history: Typhoid at 12; four years, occasional cramps. Onset: Chronic obstruction, especially loud splashing sounds. Bowels: Pain, followed by diarrhæal stools. Tumor: Size of fist over cæcum. Distention: Vomiting and pain. Operation: Irreducible; resection, end-to-end by suture. Variety: Ileocæcal. Recovered; four years after, well. Pathological remarks: Polyp size of bean in invagination; multiple polyp in cæcum.

Case 71 (Von Eiselsberg, *Arch. f. klin. Chir.*, Bd. 69).—Female, age 19. Prior history: Obstipation for years, especially last eight days; two days severe colic and vomiting. Rectal examination: Blood last twenty-four hours. Tumor: Below navel on right side, long tumor, disappearing later. Distention: Slight. Operation: Tear in attempted reduction; resection; end-to-end suture. Variety: Iliac. Died. Pathological remarks: Polyp.

Case 72 (*Ibid.*).—Male, age 54. Prior history: Six weeks, standing; onset with obstruction, relieved, with colic still persisting. Transverse movable tumor to right of navel. Operation: Reduction; resection of affected segment; end-to-end by suture. Variety: Ileocæcal. Recovered. Pathological remarks: Numerous polypi; one month later patient died from intercurrent disease.

Case 73 (Ray, *Lancet*, 1905, i, 567).—Female, age 30. Prior history: Pain for past six months, chiefly at and after defecation, in left iliac and lumbar; forty-eight hours, severe pain and vomiting. Rectal examination: Protrusion of tumor with enema. Operation: Reduction; removal of growth through enterotomy. Variety: Sigmoid. Recovered. Pathological remarks: Subserous lipoma.

Case 74 (Willard, *Tr. Chicago Path. Soc.*, 1907, 7, p. 174).—Male, age 30. Prior history: Two mild attacks of obstruction twelve and six months ago; one week ago, absolute constipation, increasing pain and tympanitis, vomiting; cathartic only. Bowels: Constipation. Rectal examination: Negative. Distention: Great; visible peristalsis. Operation: Resection; end-to-end suture. Variety: Jejunal. Recovered.

Case 75 (Chassignac, *Bull. de la Soc. Anatomique*, 1859, 2 s, iv, p. 205).—Male, age 39. Onset: Three months; sudden pain. Bowels: Constipation. Operation: Artificial anus. Variety: Ileocolic. Died. Pathological remarks: Polyp at apex.

Case 76 (Hulke, *Lancet*, 1879, vi, 810).—Female, age 16. Prior history: Similar attack two years ago. Onset: Sudden pain and vomiting. Abdominal tumor. Operation: Artificial anus. Variety: Ileocæcal. Died. Pathological remarks: Lipomatous polyp at apex.

Case 77 (Marchand, *Le Progres. Med.*, 1882, No. 11, p. 202).—Female, adult. Onset: Nine months recurrent. Bowels: Constipation becoming absolute. Rectal examination: Tumor 8 cm. from anus. Operation: Artificial anus. Variety: Sigmoidal. Died. Pathological remarks: Lipoma at apex.

Case 78 (Whipham, *Clin. Soc. Trans.*, 1891, xxiv, p. 95).—Female, age 29. Prior history: Many years umbilical pain, indigestion. Onset: Three weeks; pain. Bowels: Constipation. Rectal examination: Blood. Distention. Operation: Reduction of volvulus; jejunal intussusception. Died. Pathological remarks: Autopsy: Axial and jejunal looped volvulus; above this a thumb-sized polyp, about 5 ft. from pylorus.

Case 79 (Nothnagel, *Spezielle, Path. and Chir.*, 17, p. 316).—Male, age 50. Prior history: Fourteen months ago similar attacks lasting four months; one to three days' duration. Onset: Sudden pain and vomiting. Bowels: Increased peristalsis. Tumor: Epigastric. Rigidity: Right lower quadrant. Operation: Resection. Variety: Ileocæcal. Cured. Pathological remarks: Polyp at apex.

Case 80 (Fenger, *Hospitalsted*, 1904, No. 26).—Age 17. Prior history: Three years; diagnosis, peptic ulcer, gall-stones; exploratory operation, negative. Onset: Symptoms of obstruction. Tumor: Intermittent, appearing after previous operation. Operation: Resection. Variety: Enteric. Cured. Pathological remarks: Polyp at apex.

Case 81 (Rydygier, *Deut. Zeit. f. Chir.*, 1895, xlii, 113).—Male, age 32. Onset: Three weeks. Operation: Descending invagination because of walnut-sized fibromyoma; resection; artificial anus. Died. Pathological remarks: Perforative peritonitis.

Case 82 (*Ibid.*).—Male, age 22. Onset: Three years; acute, twenty days ago. Bowels: Constipation. Rectal examination: Bloody stools. Operation: Colic to anus; suture of perforation; artificial anus. Died. Pathological remarks: Polyp at apex.

Case 83 (Delore, *Rev. de Gyn. and Chir. Abdom.*, 1905, 9, 641).—Male, age 42. Onset: Sudden pain. Tumor. Operation: Reduction, resection. Variety: Ileocolic. Cured. Pathological remarks: Fibromyxoma at apex.

Case 84 (Hughes, *Lancet*, 1905, ii, 829).—Male, age 23. Prior history: Four years, typhoid; one year, four days of pain in right lower quadrant. Onset: Sudden, two days of pain and vomiting. Rectal examination: Blood. Tumor: In pelvis by rectal. Distention: Signs of peritonitis. Operation: Peritonitis. Variety: Ileal. Resection. Pathological remarks: Polyp at apex.

Case 85 (Andrews, *ANNALS OF SURGERY*, xliii, 473).—Male, young adult. Prior history of trauma: Jumped 5 ft. Onset: Immediately, sudden pain. Operation: Gangrenous ileocolic; resection. Died. Pathological remarks: Pedunculated fibropapilloma.

Case 86 (Royster, *N. Albany Med. Herald*, 1905, 24, 258-260).—Male, age 42. Prior history: Six months, occasional indigestion and vomiting. Onset: Four months, recurring attacks abdominal pain. Bowels: Constipation. Rectal examination: Mucus. Tumor: Sigmoid region. Distention. Operation: Reduction; excision of tumor. Variety: Ileal, looking as if tied in knot. Cured. Pathological remarks: Tumor pure fibroma.

Case 87 (Salzer, *ANNALS OF SURGERY*, 1907, xlv, 730-732).—Female, age 16. Onset: Sudden, four days of pain, vomited during examination. Tumor: Right of umbilicus, size of orange. Rigidity: Right rectus muscle. Operation: Ileocolic, reduced; excision of pedunculated tumor. Pathological remarks: Myoadenoma of ileum.

Case 88 (Lorenz, *Jahr. d. zw. Ch. klinik. Wies.*, 1906-07, 41-44).—Male, aged 58. Onset: Gradual; symptoms of chronic intestinal stenosis. Tumor: Sausage-shaped, transverse, alternately hard and soft; at left extremity hard, egg-shaped tumor. Operation: Ileocæcal invagination; tumor on ileocæcal valve; hard nodes in mesentery; resection of lower ileum, cæcum, ascending colon. Cured. Pathological remarks: Lipoma.

Case 89 (Shetton, *Brit. Med. Jour.*, 1908, i, 190).—Female, age 25. Onset: Acute pain and vomiting. Tumor: Indefinite; right inguinal region. Operation: Enteric, irreducible; resection. Pathological remarks: Sessile polyp at apex.

Case 90 (Leuret, *Bull. et N. Anat.*, 1907, v, 82, p. 652).—Female, age 45. Onset: Acute pain and vomiting. Bowels: No stool or gas passed for four days. Distention. Operation: Ileal, $\frac{1}{2}$ metre above cæcum; reduction; excision of tumor. Died. Pathological remarks: Sessile myxofibroma.

Case 91 (Haeberlin, *Cor. Bl. f. Schw. Aertz.*, 1908, 38, 211, 248).—Female, age 66. Prior history: Two months, diarrhœa and emaciation. Onset: Ten days, pain and vomiting. Bowels: Partial occlusion. Distention. Operation: Enteric, with hard body at apex; attempt to reduce caused tear; resection. Cured. Pathological remarks: Fibroma; fecal fistula twelfth day.

Case 92 (*Ibid.*).—Female, age 58. Prior history: Gall-stones. Onset: Sudden pain and vomiting. Bowels: Constipation. Rectal examination: Blood. Tumor: Firm, kidney-shaped, movable. Distention: Right side.

Operation: Ileocæcal; irreducible; enterostomy. Died. Pathological remarks: Autopsy: Pedunculated hard fibroma in lumen of intestine.

Case 93 (Delore, *Rev. de Chir.*, 1908, vol. 38, 39-67).—Female, age 36. Prior history: Four months, pain in right lower quadrant with tumor; constipation. Onset: Three days, acute. Bowels: Absolute constipation. Rectal examination: Blood. Tumor: Right lower quadrant. Distention. Operation: Ileocæcal; irreducible; end-to-end suture. Died on seventh day. Pathological remarks: Pedunculated myoma at apex.

Case 94 (*Ibid.*).—Male, age 42. Onset: Five months, colic and vomiting. Bowels: Constipation. Rectal examination: Negative. Tumor: Negative. Distention: Negative. Operation: Ileocæcal; incision of colon, through opening resection intussusceptum and tumor at apex. Cured. Pathological remarks: Fibromyoma.

Case 95.—Male, age 39. Onset: Eleven weeks, recurrent pain. Bowels: Tenesmus. Rectal examination: Blood and mucus. Tumor: Left hypochondrium. Operation: Resection. Pathological remarks: Benign, variety not stated.

Case 96 (Haasler, *V. Langenbeck Arch.*, 1902, Bd. 68, p. 817).—Male, age 26. Prior history: Acute abdominal pain; recurred in nine days; continuous vomiting (fecaloid). Onset: Acute pain, hiccough. Bowels: Constipation. Rectal examination: Mucus. Tumor: Left lower quadrant, movable. Operation: Resection; rupture; necrotic bowel. Died. Pathological remarks: Polyp at base of intussusception.

Case 97 (*Ibid.*).—Male, age 35. Prior history: One year, rumbling in abdomen, with occasional sudden onset of constipation, meteorism and pain about umbilicus. Onset: Seven weeks, severe; more frequent pain and vomiting (fecal). Bowels: Diarrhœa. Rectal examination: Hard mass. Distention. Operation: Peritonitis, enteric; reduction; resection Meckel's diverticulum; artificial anus. Died. Pathological remarks: Autopsy showed Meckel's diverticulum 2.18 m. from ileocæcal valve, invaginated; at its base a plum-sized fibrous tumor.

Case 98 (*Ibid.*).—Male, age 25. Onset: One week, sudden pain and vomiting. Bowels: Diarrhœa. Rectal examination: Pus. Tumor: Left of umbilicus, moving to left. Operation: Colic; resection of mass size of three fists. Pathological remarks: Polyp (lipoma) at apex.

Case 99 (Herbung, *Arch. f. klin. Chir.*, 1902, vol. 68, xliii, p. 1009).—Female, age 52. Prior history: Eleven months, pain, bloody mucus, constipation. Onset: Eleven days, pain and vomiting. Bowels: Constipation absolute. Rectal examination: Rectal tumor. Operation: (1) Incision of rectum (posterior route), artificial anus; (2) resection of tumor. Cured. Pathological remarks: Variety not given.

Case 100 (Don, *Lancet*, 1909, i, 1107).—Female, age 44. Onset: Vomiting, chronic course. Rectal examination: Blood and mucus; prolapse of tumor with movement. Operation: Resection through anus, followed by reduction through laparotomy. Sigmoid. Recovered. Pathological remarks: Papilloma.

Case 101 (Riedel, *Deut. med. Woch.*, 1909, 35, 1654).—Male, age 15. Prior history: Periodic pain from seventh year; frequent vomiting; attacks in morning and of one hour's duration. Bowels: Normal. Tumor: In right abdomen, during cramps only. Operation: Partial reduction; resection of segment containing growth. Iliac. Recovered. Pathological remarks: Character not stated.

Case 102 (*Ibid.*).—Female, age 48. Onset: Acute; fecal vomiting in twelve hours. Rectal examination: Invagination felt. Tumor: size of two fists, in left abdomen. Distention marked. Operation: Artificial anus, followed by resection through rectum. Sigmoid. Recovered. Pathological remarks: Character not stated.

Case 102a (Mayo Bros., personal communication).—Adult. Onset: Several months, colic. Operation: Resection. Iliac. Recovered. Pathological remarks: Adenofibroma.

Case 102b (Mayo Bros., personal communication).—Age, 14. Operation: Resection. Iliac into cæcum and ascending colon. Recovered. Pathological remarks: Myoma.

Case 102c (McWilliams).—Female, age 45. Onset: Four weeks, attacks of abdominal pain at intervals. Bowels: Diarrhœa. Rectal examination. Blood and mucus; tenesmus; rectal mass and tumor in addition on the apex. Tumor: In left lower quadrant. Operation: Attempted reduction; incision of bowel; resection. Sigmoid. Recovered. Pathological remarks: Papilloma, possibly malignant but not invading muscularis.

TABLE B.

Associated with Malignant Tumors.

Case 103 (Decker, *Bull. de la Soc. med. de la Suisse Romande*, 1880, May, No. 5).—Female, age 58. Onset: Thirteen months, pain (two days ago) and vomiting (three days ago). Tumor: Right upper quadrant. Distention: Visible peristalsis. Operation: Ileocæcal. Died. Pathological remarks: Autopsy, malignant tumor of cæcum.

Case 104 (Czerny, *Arch. f. path. Anat. Virchow*, ci, 48, 1885).—Male, age 52. Onset: Two months, pain and vomiting. Bowels: Diarrhœa. Tumor: Right upper quadrant. Operation: Ileocæcal, reduction; resection of tumor. Cured. Pathological remarks: Malignant tumor at apex, sloughing muscle wall hypertrophied (microscopically).

Case 105 (Koenig, *Arch. f. klin. Chir.*, 1890, xl, 911).—Female, age 18. Prior history: One year ago, sarcoma of lower jaw. Onset: Sudden pain and vomiting. Bowels: Constipation. Tumor. Distention: Asymetrical. Operation: Colic; ulcerating tumor at apex.

Case 106 (Koenig, *Ibid.*).—Prior history: Tuberculous. Onset: sudden pain. Rectal examination: Bloody stools; tumor palpated in rectum, level of internal sphincter. Operation: Rectal, sacral route; excision. Cured, three years. Pathological remarks: Carcinoma.

Case 107 (Rydygier, *Deut. Zeit. f. Chir.*, 1895-6, 42, 113).—Male, age 47. Onset: Nine months. Operation: Carcinoma at apex. Entero-anastomosis. Died.

Case 108.—Age 40. Onset: Six months. Tumor. Operation. Ileocæcal; resection. Cured. Pathological remarks: Adenocarcinoma.

Case 109 (Paetzold, *Deut. med. Woch.*, 1906, 32, 34).—Adult. Onset: Pain. Bowels: Diarrhœa. Tumor. Variety: Ileocæcal. Pathological remarks: Adenocarcinoma, ileocæcal valve.

Case 110 (*Ibid.*).—Adult. Onset: Pain. Bowels: Diarrhœa. Tumor. Variety: Ileocæcal. Pathological remarks: Alveolar sarcoma, ileocæcal valve.

Case 111 (Shetton, *Brit. Med. Jour.*, 1908, i, 190).—Male, age 50. Prior history: Six months, similar attack. Onset: Acute; absolute constipation. Mass in rectum. Reduced by rectal manipulation under ether. One week later rectal tenesmus. Blood and mucus. Ulcerated intussusception protruding from anus. Operation: Reduction and resection of colic variety. Pathological remarks: Malignant sessile polyp in sigmoid.

Case 112 (Haeberlin, *Corr. Bl. f. Schw. Aert.*, 1908, 38, 211-248).—Female, age 56. Prior history: Seventeen years ago, colicky pains; six months, loss of appetite and weight. Onset: Six months. Bowels: Diarrhœa. Tumor: Area of transverse colon. Visible peristalsis. Operation: Cæcal in ascending colon, reduced; resection of tumor. Pathological remarks: Gelatinous carcinoma.

Case 113 (Combs, *Wis. Med. Jour.*, 1907-8, vi, 251-255).—Male, age 68. Prior history: Four years, primary growth in left malar region. Onset: Latterly pain. Bowels: Constipation, alternating with fetid diarrhœa. Rectal examination: Sense of tumor high in rectum. Distention: Slight. Operation: Enteric; reduction; resection of tumor. Cured. Pathological remarks: "Melanotic epithelioma."

Case 114 (*Ibid.*).—Female, adult. Onset: Three months, no vomiting. Bowels: Finally absolute constipation. Rectal examination: Apex of invagination felt in rectum with irregular mass in its centre. Operation: Sigmoid, reducible; resection of tumor. Cured. Pathological remarks: Malignant with glandular enlargement.

Case 115 (Coffey, *ANNALS OF SURGERY*, 1907, xlv, 38-42).—Male, age 50. Onset: Thirteen days, "condition extreme." Rectal examination: Apex protruded through anus. Operation: Anastomosis. Died. Pathological remarks: Carcinoma of sigmoid.

Case 116 (Riess, *Am. Jour. Med Sc.*, 1907, n. s. 134, 841-849).—Male, age 40. Prior history: Sarcoma of iris removed nine months ago; melanosarcomatosis present. Onset: Sudden pain and vomiting. Bowels: Stools small. Tumor. Variety: Iliac, 1 foot long; marked involvement by sarcoma.

Case 117 (Mayo, *ANNALS OF SURGERY*, 1896, 733).—Female, age 36. Prior history: Two years, movements difficult and with pain; six months, vomiting. Onset: For few days obstruction pronounced. Bowels: Constipated, occasional blood. Tumor: Size of egg, can be brought into pelvis under anæsthetic; continuing with soft tumor above. Rectal examination: Blood. Distention, tenderness. Operation: Reduced with some difficulty, especially apex; resection; end-to-end with Murphy button.

Iliac, upper, 15 inches in length. Recovered. Pathological remarks: Adenoma, with carcinomatous degeneration.

Case 118 (McBurney, *ANNALS OF SURGERY*, i, 1896, p. 441).—Female, age 40. Onset: Sharp pain, in almost daily attacks; no vomiting. Bowels: No constipation. Smooth tumor in left pelvis. Rectal examination: Normal. Distention frequent; tenderness. Operation: Reduction; excision; end-to-end with Murphy button. Enteric. Recovered. Pathological remarks: Myxosarcoma.

Case 119 (Meyer, *ANNALS OF SURGERY*, 1896, i, 443).—Female, age 46. Prior history: Symptoms of subacute appendix for ten days; sudden obstruction shortly after. Operation: Reduced; a second one at end of first also reduced; sessile tumor felt; resection; end-to-end with Murphy button. Iliac. Recovered. Pathological remarks: Fecal fistula for few days; sarcoma.

Case 120 (*Ibid.*).—Boy. Prior history: Chronic obstruction; loud gurgling. Visible peristalsis. Operation: Reduced; resection; end-to-end with Murphy button. Ascending and transverse colon. Recovered. Pathological remarks: Sarcoma, lower end of ascending colon; subsequent death.

Case 121 (Deichert, *Dissert. Gött.*, 1895).—Male, age 46. Prior history: No symptoms. Operation: Several enteric invaginations. Pathological remarks: Metastatic lymphosarcoma in stomach and intestine.

Case 122 (Marchand, *Berl. klin. Woch.*, 1896, No. 6).—Male, old. Prior history: Primary parotid sarcoma. Operation: Jejunal into cæcum. Pathological remarks: Melanosarcoma.

Case 123 (Brunner, C., *Beitrag*, v 25, p. 344).—Male, age 56. Prior history: Digestion disturbed for years; one year ago, bloody diarrhœa. Rectal examination: Tumor advances in straining. Operation: Sacral resection for invaginated carcinoma. Pathological remarks: In part colloid, in part cylindrical.

Case 124 (Fleiner, *Virchow, Arch.*, Bd. 101, p. 484).—Male, age 45. Prior history: Pain, irregular stool, and tumor for one year. Very movable tumor. Rectal examination: Fourteen days, blood. Operation: Partial reduction; resection; circular enterorrhaphy. Ileocæcal. Died. Pathological remarks: Carcinoma of cæcum and ascending colon.

Case 125 (Billroth, *Arch. Ch.*, 1888, Bd. 43).—Male, age 40. Prior history: Eight months, pain and vomiting. Tumor: Variable, hard tumor under umbilicus. Rectal examination: Blood, two months. Operation: Irreducible; torn in attempt; resection; circular suture. Cæcal. Recovered. Pathological remarks: Carcinoma.

Case 126 (Senn, *Jour. Am. Med. Ass.*, 1890, p. 845).—Female, age 53. Prior history: Vomiting for one year. Tumor: Very variable, size of orange, above and to right of navel. Operation: Disinvagination; resection; lateral implantation. Variety: Cæcum into transverse colon. Died. Pathological remarks: Carcinoma, valve of Bauhini.

Case 127 (Billroth, 1890).—Male, age 32. Prior history: Colic three months in navel region. Tumor: Sausage shaped, above and to right of navel. Operation: Partial reduction; resection of ileum and cæcum;

circular suture. Variety: Cæcum into transverse colon. Died. Pathological remarks: Carcinoma of cæcum.

Case 128 (König, *Arch. klin. Chir.*, 1890, Bd. 40).—Female, age 18. Prior history: Primary sarcoma of tonsil; violent colic since. Tumor: Size of fist, above and to left of navel. Rectal examination: Blood and mucus. Operation: Resection of intussusceptum through cut in intussusciens. Colon. Died. Pathological remarks: Sarcoma, valve of Bauhini.

Case 129 (Von Baracz, *Arch. klin. Chir.*, 1891).—Male, age 8. Prior history: Painful abdominal crises, thirteen weeks. Tumor: Oval, ventral, movable in upper left hypochondrium. Rectal examination: Blood in stools. Operation: Irreducible, ileocæcal into descending colon; enterostomy. Died. Pathological remarks: Sarcoma, valve of Bauhini.

Case 130 (MacCormac, *Lancet*, 1892, p. 310).—Male, age 36. Prior history: Painful abdominal crises for fifteen months. Tumor: Intermittent, cylindrical, immovable, in right iliac fossa. Operation: Reduced to end of colon; resection; artificial anus, subsequently closed. Ileocæcal. Recovered. Pathological remarks: Carcinoma of valve of Bauhini.

Case 131 (Barton, *ANNALS OF SURGERY*, 1893, p. 322).—Male, age 27. Prior history: Occasional obstruction for some weeks. Operation: Irreducible; resection; artificial anus. Ileocæcal. Recovered. Pathological remarks: Epithelioma of valve of Bauhini; death in operation for closure of artificial anus.

Case 132 (Körte, *Beitrag Bruns*, Bd. 40, p. 523).—Male, age 49. Prior history: Eighteen months, pain in right hypogastrium with constipation. Tumor: Transverse, sausage shaped, below navel, slightly movable. Operation: Resection without attempt at reduction; end-to-end with Murphy button. Ileocæcal. Recovered. Pathological remarks: Lymphadenoma of valve of Bauhini.

Case 133 (Lowenstein, *Ver. d. Deut. G. Ch.*, 1890, 94-97).—Male, age 56. Prior history: Occasional abdominal pain for three months with emaciation. Bowels: Persistent constipation; occasional diarrhœa. Tumor: In left upper segment, elastic, size of several fists. Rectal examination: Tenesmus. Operation: Resection; end-to-end with suture. Ileum into colon. Recovered. Pathological remarks: Carcinoma, cæcum.

Case 134 (Lejars, *Rev. de Gyn. e. Chir. abd.*, 1897, i, 1029).—Female, age 40. Prior history: Two years, emaciation; six months, colicky attacks of pain; finally obstruction and vomiting. Bowels: First glairy stools, then diarrhœa. Tumor: Firm, very movable to left navel. Visible peristalsis. Operation: Irreducible; resection after division; end-to-end with Murphy button. Ileocæcal to ascending colon. Recovered. Pathological remarks: Lymphadenoma of valve of Bauhini.

Case 135 (Wallenberg, *Berl. klin. Woch.*, 1864, p. 497).—Female, age 21. Prior history: Three days, constipation, followed by vomiting, cramps and diarrhœa. Distention for one week. Operation: Discharge of slough, one foot long, of small intestine without relief. Died. Pathological remarks: Five and one-half weeks after, autopsy showed sarcoma of cæcum.

Case 136 (Pitts, *Brit. Med. Jour.*, 1901, ii, 574).—Male, age 32. Prior

history: Ill four months. Operation: Resection; lateral implantation. Cæcal. Recovered. Pathological remarks: Malignant growth at starting point.

Case 137 (Ludloff, *Grenz. Gebiet.*, 1898, 3, 600).—Male, age 6. Prior history: Five weeks after short attack of pain, subsiding with splashing sound, lately including pain; emaciated. Bowels: Constipation; lately diarrhœa. Tumor: Size of fist, below right border of ribs. Visible peristalsis on rubbing abdomen. Operation: Resection; end-to-end circular suture. Ileocæcal to one-half transverse colon. Recovered. Pathological remarks: Tumor at neck; lymphosarcoma; glandular enlargement; well four and one-half years later.

Case 138 (Von Eiselsberg, *Archiv. klin. Chir.*, Bd. 69, p. 1).—Female, age 40. Prior history: Colic eleven weeks, eleven days constipation. Bowels: Tenesmus, three weeks. Rectal examination: Blood and mucus eleven days, tumor in rectum fourteen days. Some distention. Operation: Resection; end-to-end suture. Sigmoid. Pathological remarks: Carcinoma.

Case 139 (Krecke, *Munch. med. Woch.*, 1900, i, p. 42).—Female, age 63. Prior history: Dysentery sixteen years ago; one year, irregular stools, vomiting, pain in right side in attacks; tender tumor. Tumor: Egg tumor in left lower abdomen, intermittent in appearance. Vaginal and rectal examination negative. Visible peristalsis. Operation: Resection, after preliminary division of colon; end-to-end suture. Ileum into ascending colon. Recovered. Pathological remarks: Carcinoma of cæcum; well one year after operation.

Case 140 (Rowlands, *Med. Press and Circ.*, 1909, 88, p. 348).—Male, middle age. Prior history: Eighteen months, occasional pain and bleeding from anus; acute for past three days; vomiting. Bowels: No stool. Rectal examination: Invagination in rectum. Distention increasing. Operation: Removed through anus, followed by reduction and suture through laparotomy. Sigmoid. Recovered. Pathological remarks: Carcinoma.

Case 141 (Riedel, *Deut. med. Woch.*, 1909, 35, 1654).—Male, age 43. Onset: Acute, vomiting. Bowels: Dark, non-bloody stool with enema. No tumor. Distention marked. Operation: Small multiple tumors felt in intestinal wall. Iliac. Died. Pathological remarks: Invagination 10 inches above ileocæcal valve; multiple sarcoma in Peyer's patches with mesenteric glands involved.

Case 142 (Dujon, *Bull. et mem. Soc. Anat.*, 1909, 84, 515-533).—Male, age 54. Prior history: Chronic obstruction for two months. Operation: Resection; lateral anastomosis with Murphy button. Near cæcum. Died. Pathological remarks: Second invagination at duodenum, both due to annular cancer.

Case 143 (Kammerer, *ANNALS OF SURGERY*, Aug., 1898).—Female, age 50. Prior history: Occasional pain and vomiting. Bowels: Alternately constipation and diarrhœa. Tumor: In pelvis, left side, somewhat changeable. Rectal examination: Tip of rounded mass felt. Operation: Reduced, enterostomy; wide excision of growth. Enteric. Recovered. Pathological remarks: Sarcoma.

TABLE C.

Acute Cases without Cause.

Case 195 (Elliot, *Tr. Am. Surg. Ass.*, 1905, 23, 295).—Male, age 38. Onset: Two weeks, vomiting. Bowels: Diarrhœa. Tumor: Left lower quadrant, movable. Distention and rigidity. Operation: (1) Incised colon to relieve constriction; two attempts to close artificial anus. Cured.

Case 196 (Hall, *St. L. Clinic*, 1906, 19, 39-47).—Female, age 52. Prior history: Indigestion, occasional nausea and vomiting. Onset: Two hours, pain and vomiting. Tumor: Right lower quadrant. Operation: Ileocæcal; reduction. Cured.

Case 197 (Raley, *Den. M. Times*, 1905-6, 25, 447-451).—Female, age 35. Prior history: Ten years, neuralgia of stomach. Onset: Sudden pain. Tumor: Felt under anæsthesia. Operation: Ileal, reduced. Cured. Following operation, good health but for hyperchlorhydria. One year after first attack, same symptoms, with vomiting. Tumor: Not found. Distention: Extreme peristalsis. Operation: Ileal, higher up, reduced. Cured.

Case 198 (Third, *Queen's M. Quart.*, 1905-6, 10, 70-73).—Female, age 52. Prior history: Recurring attacks July, 1903, to Nov., 1905, with progressively worse symptoms. Onset: Last attack sudden, pain and vomiting. Bowels: Diarrhœa and constipation, irregular. Rectal examination: Large tumor; blood. Tumor: Left lower quadrant. Distention: marked peristalsis. Died. Pathological remarks: Autopsy: remainder of colon and all but 8 ft. of small bowel in descending colon, sigmoid, rectum and protruding.

Case 199 (Sherran, *Clin. J. Lond.*, 27, 184-187).—Female, 49. Prior history: Umbilical hernia. Onset: One day, sudden pain and vomiting. (Hernia swollen, easily reduced.) Rectal examination: Blood. Tumor: Hernia (umbilical). Operation: Free fluid; relief of strangulated hernia. Cured. Pathological remarks: Nine days after operation passed section of intestine $3\frac{1}{2}$ inches long; eighteen months later, signs of obstruction; operation, mass of adhesions at transverse colon; ileocolostomy.

Case 200 (Ware, *Lancet*, 1906, ii, 1721).—Female, age 27. Onset: Sudden pain. Bowels: Constipation. Tumor: Ill-defined, right lower quadrant. No distention. Operation: Iliac, irreducible; resection; suture. Cured. Pathological remarks: Twenty-two months later, symptoms of acute obstruction; rigid abdomen; operation; gangrenous lump, composed of small intestine twisted on itself; resection with Murphy button; cured.

Case 201 (Thompson, *Brit. Med. Jour.*, 1907, i, 1867).—Male, age 52. Onset: Sudden, five days, vomiting. Bowels: Constipation. Operation: Lower iliac; reduced. Died same evening.

Case 202 (Combs, *Wis. Med. Jour.*, 1907-08, 6, 251-255).—Female, age 54. Onset: Acute, pain and vomiting relieved by enemas; recurred in two days with fecal vomiting. Tumor: Right pelvis. Operation: Iliac, 9 inches above ileocæcal valve; attempt at reduction, tear; resection. Cured.

Case 203 (Riess, *Am. Jour. Med. Sc.*, 1907, n. s. 134, 841).—Male, age 27. Onset: Acute, forty-eight hours, pain and vomiting. Operation: Ileocolic, irreducible; ileocolostomy. Died.

Case 204 (Codman, *Bost. Med. and Surg. Journ.*, 1908, 158, 439-446).—Male, age 43. Onset: Acute, five days, pain and vomiting. Rectal examination: Blood. Tenderness in right lower quadrant. Operation: Ileocæcal, irreducible; Mixer tube in ileum, neck of mass left in wound after ligation of mesocolon; ten days later, attempt at enterocolostomy; second attempt caused death.

Case 205 (*Ibid.*).—Male age 24. Onset: Sudden, vomiting three days. Bowels: Moved. Rectal examination: Tenderness in whole pelvis, especially in right. Tumor: Right lower quadrant. Distention: Tenderness in right lower quadrant. Operation: Colic; resection. Cured.

Case 206 (*Ibid.*).—Male, age 38. Onset: Two weeks, vomiting and pain. Bowels: Diarrhœa, seven to twenty stools a day. Oval tumor in left side, doughy, firm. Rigidity, considerable. Distention, moderate. Operation: Colic, intussusceptum removed through long slit in colon; Mixer tube in same opening. Cured.

Case 207 (Elgart, *Wien. klin. Woch.*, 1903, p. 923).—Female, age 31. Prior history: Ten days ago, bloody stool. Onset: Acute, pain and vomiting. Bowels: Stool at beginning. Tumor: Oblique in right hypochondrium. Rectal examination: Blood. Operation: Reduction to 5 cm. above ileocæcal valve; then resection with end-to-end by Murphy button. Ileocolic half way up ascending colon. Recovered. Pathological remarks: No tumor or ulcer.

Case 208 (Chirat, *La Prov. Med.*, 1896, p. 604).—Female, age 19. Prior history: Peritonitis five years ago. Onset: Acute, pain and vomiting for thirty-six hours. Bowels: No stool or gas. Rectal examination: Blood from second day on. Distention moderate. Death seven days after onset without operation. Pathological remarks: Enteric invagination, upper jejunum and ileum, easily reduced; no cause.

Case 209 (Knotz, *Prag. med. Woch.*, 1896, 779).—Female, age 29. Prior history: Round worms. Onset: Acute, paroxysms of pain and vomiting. Bowels: No flatus. Tumor: Sausage-shaped, left side, not movable. Rectal examination: Mucus and blood; apex felt per rectum. Distention, beginning in right side. Operation: Complete reduction by injection of water.

Case 210 (Brunner, C., *Beitrag*, 25, p. 344).—Male, age 20. Onset: Acute pain and vomiting. Tumor: Cylindrical, in right lower quadrant. Operation: Reduction only after incision of neck of invagination; resection; end-to-end with suture. Ileocæcal. Died. Pathological remarks: No special cause.

Case 211 (Michaux, *Bull. Soc. Chir.*, 1900, p. 734).—Male, age 29. Onset: Acute pain and vomiting. Tumor: Sense of tumefaction. Rectal examination: No blood or mucus. Distention moderate; rigidity. Operation: Reduced. Enteric. Recovered. Pathological remarks: No cause.

Case 212 (*Ibid.*).—Female, age 28. Onset: Acute pain and vomiting. Tumor: Mobile tumor in right lower quadrant, intermittent with pain.

Tenderness and rigidity in right lower quadrant. Operation: Thirteen days after onset, irreducible; resection; lateral implantation. Ileocæcal.

Case 213 (Pringle, *Brist. Med. Chir. Jour.*, Dec., 1899).—Female, age 50. Prior history: Sharp colicky pain, intermittent, six months' duration. Tumor: Firm mass below navel, during pain. Distention. Operation: Irreducible; resection; end-to-end into abdominal wall. Enteric. Died. Pathological remarks: Intussusception 3 feet from pylorus.

Case 214 (Helbring, *Cent. f. Ch.*, 1901, 672).—Female, age 39. Onset: Acute pain and vomiting. Tumor: Movable, felt per vaginam. No distention. Operation: Irreducible; resection; lateral implantation. Ileocolic. Recovered. Pathological remarks: No mention of cause.

Case 215 (Pitts, *Brit. Med. Jour.*, 1901, ii, 574).—Male, age 31. Onset: Acute, eight days' duration. Operation: Resection; enterostomy. Enteric. Died. Pathological remarks: Death from peritonitis.

Case 216 (Jenly, *Wien. klin. Woch.*, 1901, p. 1177).—Male, age 28. Onset: Acute, vomiting and hiccough. Bowels: No stool, no flatus. Abdomen retracted. Operation: Resection; lateral implantation. Iliac, gangrenous. Recovered. Pathological remarks: No special cause.

Case 217 (*Ibid.*).—Female, age 27. Onset: Acute, six days pain and vomiting. Bowels: Daily stool. Tumor: Above and to left of navel, hard tumor, sausage shaped. Rectal examination: No blood, no mucus; rectum negative. Distention: Moderate. Operation: Ileocolostomy, followed by subsequent resection. Ileocolic to splenic flexure. Recovered. Pathological remarks: Edematous condition of ileocæcal valve.

Case 218 (Ludloff, *Grenz. Gebiet.*, 1898, iii, p. 600).—Male, age 22. Prior history: Three attacks in three weeks with acute cramps of short duration, and tumor. Bowels: Daily diarrhœal stool. Tumor: Sausage-shape, above navel. Distention: Slight. Operation: Complete resection with end-to-end by suture. Ileocæcal to splenic flexure. Recovered. Pathological remarks: No cause.

Case 219 (Roberts, *Kentucky Med. Jour.*, 1909, viii, p. 1212).—Female, age 25. Prior history: Constipation and indigestion for months. Onset: Acute, colicky pain; no vomiting at first. Bowels: No stools. Oblong tumor below umbilicus. Rectal examination: Tenesmus. Rigidity: Slight. Operation: Gangrenous; resection with end-to-end suture. Iliac. Died. Pathological remarks: Death from peritonitis.

Case 220 (Poitan, *Pedriat.*, Lille, 1909, vii, 63-66).—Male, age 18. Onset: Acute, pain and vomiting, subsiding. Symptoms of peritonitis on sixteenth day. Bowels: No stool or flatus. Distention and rigidity: Slight, right side. Operation: Five feet above ileocæcal valve; resection; end-to-end by suture. Iliac. Recovered. Pathological remarks: No cause.

Case 221 (Sherran, *ANNALS OF SURGERY*, 1909, i, 875-878).—Male, age 30. Onset: Acute, pain and vomiting. Bowels: Two loose stools followed by complete constipation. Rectal examination: Blood? Distention: "Rectovesical pouch filled with fluid." Operation: Reduced with difficulty. Ileocolic. Recovered. Pathological remarks: No cause.

Case 222 (Gibbon, personal communication).—Male, age 19. Prior history: Previous good health. Onset: Sudden pain and vomiting.

Bowels: Constipation. Tumor: Right lower quadrant. Rectal examination: Negative. Rigidity. Operation: Split colon; resection of intussusceptum; lateral ileocolic anastomosis. Ileocolic. Recovered.

Case 222a (*Ibid.*).—Male, age 58. Onset: History indicating intestinal obstruction. Operation: Resection; ileostomy; colostomy. Ileocæcal. Died. Pathological remarks: Patient in bad condition; bowels gangrenous.

Case 223 (Kersten, *Deut. Zeit. f. Chir.*, 1849, Bd. 51, Hft. 56).—Male, age 30. Prior history: Two months ago, following lifting heavy weight, abdominal pain and constipation. Onset: Four days, pain. Tumor: Left side. Distention. Operation: Ileocolic, split intussusciens; resection of intussusceptum, including perforation. Recovered. Pathological remarks: Intussusceptum gangrenous; bloody purulent abdominal fluid; perforation.

Case 224 (Wilson, *Transylvania Jour. Med.*, 1835, viii, 486).—Male, age 18. Onset: Seventeen days. Bowels: Intestinal obstruction symptoms one hundred and eighty-one days. Cured. Pathological remarks: Gangrenous bowel.

Case 225 (Howse, *Med. Chi. Trans.*, 1876, lix, 85).—Male, age 33. Onset: Eighteen days. Operation: Mass taken outside abdomen and reduced, replaced. Cured.

Case 226 (Bellamy, *Brit. Med. Jour.*, 1879).—Female, age 34. Onset: Pain and vomiting (fecal). Rectal examination: Ileum and colon protruding. Abdominal tumor. Operation: Ileocæcal; bimanual reduction. Cured.

Case 227 (Kleberg, *Arch. f. klin. Chir.*, 1879, xxiv, 387).—Male, age 40. Prior history: Hernia one year before; intestinal obstruction; operation, cure. Onset: Few hours. Variety: Double, from above down and from below up, in a common intussusciens.

Case 228 (Mikulicz, Braun, *l. c.*, 690, No. 188).—Adult. Prior history: Constipation. Onset: Pain. Bowels: Constipation, followed by bloody stool. Tumor: Right lower quadrant, moved to epigastrium then to left lower quadrant. Operation: Colic into sigmoid.

Case 229 (Braun, *Verh. d. Deut. Gesell. f. Chir.*, 1885, 501).—Female, age 36. Prior history: Slight pain in right lower quadrant. Onset: Eight days, pain and vomiting. Distention. Operation: Ileocæcal; resection; suture of perforation. Died. Pathological remarks: Autopsy: General peritonitis, gangrenous bowel.

Case 230 (Kuster, *Verh. d. Deut. Gesell. f. Chir.*, 1879, i, 81).—Male, age 42. Onset: Six days, pain and vomiting (fecal). Rectal examination: Blood. Operation: Ileocæcal; resection. Died. Pathological remarks: Gangrenous bowel, peritonitis.

Case 231 (Wahl, Braun, *l. c.*).—Age, 44. Onset: Gradual for nine days, vomiting. Bowels: Constipation. Rectal examination: Pro-lapse from anus, size of child's head on ninth day. Rigidity: At localized spot, inferred to be tumor. Operation: Artificial anus; ileocæcal. Died. Pathological remarks: 29 cm. ileum, ascending colon, and transverse colon in descending colon; ileocæcal valve at anus.

Case 232 (Winniwarter, *Mitt. auf. d. XIV Cong. d. Deut. Gesell. f. Chir. Brieflich. Notiz.*).—Male, age 60. Onset: Sudden, while at stool, pain. Bowels: Constipation absolute. Tumor: Left lower quadrant. Operation: Artificial anus. Pathological remarks: Bloody serum in abdomen.

Case 233 (Carrier, *Gaz. med. de Lyon*, 1866, No. 4).—Male, age 23. Onset: Sudden. Tumor: Right lower quadrant. Operation: Artificial anus. Ileocæcal. Died.

Case 234 (Braun, *Verh. d. Deut. Gesell. f. Chir.*, 1885, 501).—Male, age 63. Onset: Sudden pain and vomiting (fecal). Tumor: Parallel to Poupart's left lower quadrant. Distention. Operation: Resection, ileo-cæcal. Died. Pathological remarks: Necrosis, peritonitis.

Case 235 (Pilgrim, *Indian Med. Gazette*, 29, 1894, 297).—Male, age 29. Onset: Sudden pain and vomiting. Rectal examination: Rectal prolapse. Operation. Cured.

Case 236 (Rydygier, *Deut. Zeit. f. Chir.*, 1895, 6, xlii, 113).—Male, age 31. Onset: Five days. Operation: Ileocæcal into rectum; attempt at reduction, rupture; resection; entero-anastomosis. Died.

Case 237 (*Ibid.*).—Male, age 20. Onset: Sixty hours. Operation: Ileal; resection. Cured.

Case 238 (*Ibid.*).—Female, age 43. Onset: Eight days. Operation: (1) Artificial anus; (2) resection; (3) closure of artificial anus; separate operations. Cured. Pathological remarks: One year later, 50 cm. piece of bowel passed.

Case 239 (*Ibid.*).—Male, age 26. Onset: Ten days. Operation: Cæcal; resection. Died. Pathological remarks: Gangrenous bowel.

Case 240 (*Ibid.*).—Male, age 43. Onset: Fourteen days. Operation: Reduced. Variety not stated. Died. Pathological remarks: Pseudodiphtheria.

Case 241 (*Ibid.*).—Male, age 60. Onset: Ten days. Operation: Ileo-cæcal; artificial anus.

Case 242 (*Ibid.*).—Male, age 68. Onset: Three days. Operation: Colic; reduction.

Case 243 (*Ibid.*).—Female, age 56. Onset: Eight days. Operation: Ileocæcal; resection; removal of mass per anum because of difficulty of bringing it up into abdomen. Died.

Case 244 (Bell, *Montr. Med. Jour.*, 1905, 34, 619).—Male, age 18. Onset: Sudden pain and vomiting. Bowels: Absolute constipation. Operation: Ileal; resection. Died.

TABLE D.

Acute Cases With Known Cause.

Case 174 (Burckhardt, *Bericht ü. d. Chir. Abteil. d. Ludwig's Spitalis Charlottenhilfe im Jaarh*, 1884, p. 23).—Male, age 24. Prior history: Swallowed nail four months ago. Onset: Sudden pain. Operation: Ileocæcal; reduction. Cured.

Case 175 (Saltzmann, *Leichenstern Prag. Monat.*, 1874).—Male, age

29. Prior history of trauma: Directly after lifting heavy weight. Onset: Sudden pain and vomiting (fecal). Tumor: Right lower quadrant, size of fetal head. Distention. Operation: Artificial anus, after attempt at reduction with resulting rupture. Died.

Case 176 (Alglave, *Bull. et mem. Anat.*, 82, 445-452).—Male, age 40. Onset: Acute, three days pain and vomiting. Bowels: Constipation and tenesmus. Rectal examination: Blood. Distention. Operation: Ileocaecal, irreducible; ileosigmoidostomy. Died. Pathological remarks: Autopsy, large ulcer at apex of invagination.

Case 177 (Reiss, *Am. Jour. Med. Sc.*, 1907, n. s. 134, 841-849).—Male, age 17. Prior history: Twenty-sixth day of typhoid. Onset: Acute (diagnosis, perforation). Operation: Jejunal, 3 inches below duodenum; reduced. Cured.

Case 178 (*Ibid.*).—Female, age 19. Prior history: Fortieth day of typhoid. Onset: Pain and vomiting. Bowels: Tenesmus. Rectal examination: Blood and mucus. Operation: Ileocolic, reduced. Cured.

Case 179 (*Ibid.*).—Male, age 36. Prior history of trauma: Struck just above crest of ileum by heavy beam; shock twenty-four hours, then pain and vomiting. Pelvic examination: 12 ounces bloody urine. Rigidity. Operation: Small intestine contracted in many places as if ligatured, at one point enteric invagination for 2 inches; reduction. Died. Pathological remarks: Shock.

Case 180 (Haasler, V. Langenbeck *Arch.*, Bd. 68, p. 817).—Female, age 26. Onset: Seven days, pain and vomiting. Bowels: Constipation absolute at first; bowels moved later. Distention. Variety: Ileal. Pathological remarks: Tuberculosis of intestine.

Case 181 (Ash, *Brit. Med. Jour.*, 1902, May 3).—Male, age 25. Prior history: Twenty-fifth day, normal temperature following typhoid; relapse fortieth to fifty-seventh day. Onset: Ninth day of relapse; sudden pain and vomiting; collapse. Rigidity: Right lower quadrant. Operation: Ileocolic; reduction. Cured.

Case 182 (Ross, *ANNALS OF SURGERY*, 1904, xxxix, p. 604).—Male, age 17. Prior history: Typhoid; on twenty-first and twenty-fifth days, hemorrhages. Onset: Twenty-sixth day, sudden pain. Operation: 3 feet from duodenojejunal juncture 3 inches of intussusception; reduction. Cured. Pathological remarks: Diagnosis, perforation.

Case 183 (Watkins-Pitchford, *Brit. Med. Jour.*, Sept. 6, 1902).—Male, age 29. Prior history: Convalescent from typhoid. Onset: Sudden pain and vomiting (blood); collapse. Rectal examination: Black stools. Signs of peritoneal irritation. Intussusceptions in small intestine. Pathological remarks: Mucosa injected.

Case 184 (Fuschius, *Hufeland Jour.*, Bd. lx, 42).—Male, age 28. Prior history of trauma: While on a walking trip suddenly bent and recovered. Onset: Immediate, of pain, vomiting becoming fecaloid; eighteen days, acute symptoms with eructations. Tumor: Upper umbilical region. Distention: Appeared late. Operation: Laparotomy, ileocolic or colic; incised colon; reduction bimanually (in and outside colon); suture of opening; sutured ends carried out of abdomen and removed thirteen days

after operation. Cured. Pathological remarks: Stool four days after operation; complete recovery in thirteen days.

Case 185 (Pridmore, *Cent. f. Med.*, xviii, p. 890).—Male, age 40. Prior history: Dysentery. Onset: Peritonitis, fever. Bowels: Pus in stools. Rectal examination: Blood. Tumor: Soft, under right hypochondrium. Died. Pathological remarks: Gangrenous ileo-cæcal invagination; dysenteric ulcer in large intestine.

Case 186 (Stretton, *Lancet*, 1894, ii, 797).—Male, age 20. Prior history of heavy lifting. Onset: Acute pain and vomiting. Bowels: Natural movement; flatus at intervals. Rigidity; no distention; tenderness. Operation: Forty-eighth hour; invagination of lower ileum; reduced with difficulty. Recovered.

Case 187 (Michaux, *Kor. Bl. Schw. Aert.*, 1896, No. 26, p. 148).—Male, age 8. Prior history: Fell 12 feet, and walked home bent over. Onset: Twenty-four hours after, signs of peritonitis. (At end of week, prolapse of intestine, with signs of obstruction; death on eighteenth day.) Operation: Showed retroperitoneal hæmatoma. Died. Pathological remarks: Autopsy showed enteric invagination with ascarides above.

Case 188 (Steiner, *Cent. f. Chir.*, 1896, 310).—Female, age 21. Onset: Acute, six days' duration. Rigidity and tenderness in iliac region. Operation: Enteric, lower ileum, gangrenous; resection; end-to-end suture with Murphy button. Recovered. Pathological remarks: Date stone found in specimen.

Case 189 (Batul, *Prov. Med.*, 1901, p. 317).—Male adult. Prior history of trauma: Strenuous ride. Onset: Acute, pain and vomiting. Bowels: No gas or stools for two days. Rigidity and tenderness over spleen; no visible peristalsis. Operation: Tubercular ileum. Died. Pathological remarks: Multiple ulcers in end of jejunum; tuberculous ulcer at apex of invagination; small cavity in lung.

Case 190 (Ludloff, *Grenz. Gebiet.*, 1898, iii, p. 600).—Female, age 47. Prior history: First attack sixteen years ago. Onset: Pain ten weeks ago, becoming more frequent and ending in acute attack three days ago; vomiting. Rectal examination: Once blood; nothing per rectum. Tumor: Sausage-shaped, intermittent, with pain. Visible peristalsis; distention general; tenderness. Operation: Ileocæcal into lower sigmoid, ulcer at apex; ileum and sigmoid anastomosis. Died. Pathological remarks: Secondary obstruction on eighteenth day from extension of invagination; perforation; peritonitis.

Case 191 (Von Eiselsberg, *Archives*, 69).—Female, age 48. Prior history: Two weeks colic, more frequent of late. Onset: Past two days fecal vomiting. Bowels: Constipation. Distention very great; visible peristalsis. Operation: Ileocæcal into middle descending colon; reduction; resection of circular stricture of ileum; end-to-end by suture. Death from cardiac complication after wound was nearly healed.

Case 192 (Vignard, *Lyon. Med.*, 1905, i, 215).—Female, age 23. Prior history: Abdominal trauma fifteen days ago. Onset: One attack six weeks ago with tumor subsiding; no vomiting; after ten days, recurrence.

Bowels: Serous, not bloody diarrhœa. Tumor: Irregular, sausage-shaped, in right upper quadrant; tumor on left with recurrence. Operation: Partially reduced ileocæcal; lateral implantation after resection. Died. Pathological remarks: No leakage had occurred.

Case 193 (Ainsley, *Brit. Med. Jour.*, 1897, ii, p. 82).—Male, age 15. While playing football, sudden pain and vomiting on kicking the ball. Bowels: Constipation; always acted to enema. Rectal examination: Mucus and blood after three days. No tumor. Operation: Gangrenous; resection by Maunsell's method. Cured. Enteric, 3 inches long. Remarks: In perfect health fifteen months after.

Case 194 (Clubbe, *Brit. Med. Jour.*, 1897, ii).—Male, age 10. Prior history of trauma: After pulling cart. Onset: Pain and vomiting, three days' duration. Bowels: Constipation after action. Tumor: Elongated, below navel. Operation: Reduction easy. Cæcum into descending colon. Recovered.

TABLE E.

Chronic Cases without Cause.

Case 264 (Braun, Hanff, *Verh. der Deut. Gesellsch. f. Chir.*, 1885, 501).—Adult. Onset: Seven months, recurrent colic. Rectal examination: Mass in anus; foul mucoid discharges. Operation: Artificial anus. Died. Remarks: Type not given.

Case 265 (Besnier, *Etud. s. l. diagn. et s. l. Trait. de l'Intestin dans la cavité de l'abdomen*, Paris, 1857, p. 62).—Age 23. Onset: Two months, sudden pain; three days, vomiting (fecal). Bowels: Constipation followed by bloody stools. Rectal examination: Blood. Variety: Ascending, sigmoid into colon. Died.

Case 266 (Vergely).—Female, age 19. Prior history: Digestive disturbances one year. Onset: One year pain, vomiting two weeks. Bowels: One year constipation. Rectal examination: Blood; fetid mucus. Operation: Sigmoidorectal, reducible. Pathological remarks: Gangrenous perforation.

Case 267 (Riedel, *Mitt. a. d. Grenz. Geb.*, xiv, 1, 2).—Female, age 50. Onset: Beginning ten days after last child; fourteen years, recurrent attacks; acute onset; pain and vomiting sudden, three days' duration. Bowels: Diarrhœa, constipation absolute. Rectal examination: Blood. Tumor: Epigastric, varying in size. Distention. Operation: Ileo-ileocæcal; resection. Died. Pathological remarks: Venous thrombosis; pneumonia.

Case 268 (Rydygier, *Deut. Zeit. f. Chir.*, 1895-6, xlii, 113).—Female, age 47. Onset: Eight weeks. Operation: Resection; ileocæcal. Cured.

Case 269 (*Ibid.*).—Female, age 25. Onset: Five weeks. Operation: Resection; ileocæcal. Cured.

Case 270 (*Ibid.*).—Male, age 33. Onset: Four weeks. Operation: Ileocæcal; entero-anastomosis. Cured.

Case 271 (*Ibid.*).—Female, age 22. Onset: Six months. Operation: Ileocæcal; reduction. Cured. Pathological remarks: 20 cm. long.

Case 272 (*Ibid.*).—Female, age 38. Attacks: Twenty-one days ago,

eight days ago. Operation: Colic; artificial anus. Died. Pathological remarks: Peritonitis at operation.

Case 273 (*Ibid.*).—Male, age 26. Onset: Thirty-five days. Operation: Ileocæcal; reduction. Died. Pathological remarks: Suspicious spot in bowel at operation.

Case 274 (*Ibid.*).—Male, age 30. Onset: Six weeks. Operation: Ileocæcal; reduction; anchorage of bowel to abdominal wall. Cured.

Case 275 (Delore, *Rev. de Gyn. et Chir. Abd.*, 1905, 9, 641-658).—Male, age 20. Onset: Two to three years, pain and vomiting. Bowels: Diarrhœa. Rectal examination: Blood. Tumor: Left lower quadrant. Operation: Cut intussusciens; resection of intussusceptum from inside; ileocæcal. Cured.

Case 276 (Kronbach, *Deut. med. Woch.*, 1905, i, 1782).—Age 41. Onset: Seven weeks, sudden onset of pain and vomiting. Rectal examination: Blood. Operation: Ileocæcal; reduction; resection.

Case 277 (Hartmann, *Bull. M. Soc. Chir.*, 1908, 34, 563-566).—Male, age 18. Onset: Four months, pain. Bowels: Gurgling. Rectal examination: Blood, gross and microscopically. Tumor: Mobile, felt bimanually. Rigidity: Right upper quadrant. Operation: Ileal; resection.

Case 278 (Batchelor, *N. Orl. M. & S. J.*, i, 1905, 58, 570).—Male, age 54. Onset: Sixty days, pain and vomiting. Tumor: Fluctuating mass above umbilicus. Operation: Abandoned; ileocæcal. Died. Pathological remarks: Gangrenous bowel.

Case 279 (Miller, *Am. Jour. Obst.*, N. Y., 1906, 54, 869).—Female, age 26. Prior history: Four years, attacks. Onset: Pain and vomiting. Bowels: Diarrhœa. Tumor: Size small kidney, right lower quadrant, firm, tender, freely movable. Operation: Ileocolic to splenic flexure; irreducible; ileocolostomy.

Case 280 (Jahonlay, *Lyon Med.*, 1907, 108, 1714).—Male, age 52. Onset: Two to three months, pain. Bowels: Constipation. Tumor: Hard, slightly movable, right lower quadrant. Operation: Ileocæcal, with supposed cancer; lateral anastomosis; excision. Died. Pathological remarks: Pneumonia; autopsy showed no tumor.

Case 281 (Poisson, *Gaz. med. d. Nantes*, 1908, ii, 26, 336-338).—Female, age 13. Prior history: Forty days ago occasional vomiting with bloody stools; tumor felt below and to left of umbilicus. Onset: Present attack, continuous vomiting. Rectal examination: Forty-five days ago passed slough of small intestine. Distention and visible peristalsis in present attack. Operation: Jejunal, 1 m. below pylorus; below this intestine contracted; intestine at site of former invagination makes angle.

Case 283 (Haasler, *V. Langenbeck's Arch.*, 1902, Bd. 68, 817).—Female, age 32. Onset: Three months, pain becoming severe. Bowels: Eight weeks constipation followed by diarrhœa, some flatus. Rectal examination: Protrusion from anus easily removed by knife. Tumor: Fourteen days. Distention: Asymmetrical. Variety: Ileocæcal; cæcum and appendix at anus. Died.

Case 284 (Hofmeister, *Zentbl. f. Chir.*, No. 48).—Male, age 32.

Onset: Ten weeks, typical invagination symptoms. Rectal examination: 25 cm. mass protruded from anus. Operation: Resection 140 cm. Cured.

Case 285 (Majewski).—Female, age 56. Prior history: Several years hard, tender swelling in cæcal region; six months ago sudden pain, vomiting, and diarrhœa; subsidence of acute symptoms with increase in size of tumor. Operation: Reduction. Ileum into cæcum and ascending colon. Recovered.

Case 286 (Elgart, *Wien. klin. Woch.*, 1903, p. 923).—Female, age 33. Prior history: Four months tumor in abdomen, gradual increase in size; pain in abdomen and back. Bowels: Normal. Tumor: Sausage-shaped tumor in left flank, smooth, movable. Operation: Reduced with difficulty; cæcum anchored. Ileocæcal. Recovered. Pathological remarks: No ulcer or tumor.

Case 287 (Stead, *Brit. Med. Jour.*, 1901, ii, 1458).—Female, age 72. Prior history: Chronic constipation with several attacks of colic and flatulence. Rectal examination: Protrusion of "tumor" from anus. Operation: Sphincter divided; reduction. Colon. Recovered. Pathological remarks: No mention of tumor.

Case 288 (Von Eiselsberg, *Archive*, Bd. 69).—Male, age 31. History: Eighteen days colic, followed by diarrhœa; vomiting after eating. Rectal examination: Blood for two days. Tumor: Long, hard, movable tumor in right side. Distention: Moderate. Operation: Irreducible; ileocæcal to hepatic flexure; end-to-end by suture. Recovered. Remarks: Three years after, occasional pain, stools normal.

Case 289 (*Ibid.*).—Male, age 35. Prior history: Three years, two years and six weeks ago, severe colic disappearing with enema. Bowels: Stools and gas, scant. Tumor: Sausage-shaped transverse, in upper abdomen. Operation: Reduction; resection to prevent recurrence. Ileocolic. Recovered. Pathological remarks: Three years later in excellent health.

Case 290 (*Ibid.*).—Male, age 36. Prior history: Three months, short colicky attacks; two and a half weeks ago, noticed distended loop. Bowels: Movement to enema for two and a half weeks. Distention: Two and a half weeks. Operation: Reduction; resection with end-to-end anastomosis by suture. Enteric. Recovered. Pathological remarks: Swelling, probably inflammatory, above a stricture of unknown character.

Case 291 (Baracz, *Cent. f. Chir.*, 1894, p. 622).—Male, age 19. Prior history: Three attacks of pain and vomiting, with constipation in past twenty-nine months; diarrhœa after last attack. Hard tumor in cæcal region for past year. Operation: Ileocolostomy with resection and end-to-end circular suture. Ileocæcal, irreducible. Recovered. Pathological remarks: Swelling only inflammatory.

Case 292 (Passagi, *Il Policlino*, 1905, p. 10).—Male, age 30. Prior history: Intermittent colic, with variable tumor, vomiting over a period of nine months. Bowels: Constipation. Rectal examination: Mucus but no blood. Tumor: Right upper quadrant. Operation: Reduction; endoplication of cæcum by two parallel rows on either side anterior longitudinal band. Ileocæcal. Recovered.

CASE 293 (Battle, *Med. Presse*, 1897).—Male, age 50. Prior history: Constipation, vomiting for fourteen days. Rectal examination: Blood. Tumor: sausage-shaped, in left lower quadrant. Operation: Irreducible; cæcum anastomosed to colon. Colonic.

CASE 294 (Schiller, *Beitrag*, v, 17, p. 635).—Female, age 49. Prior history: For fifteen weeks daily attacks of pain, with no stool or gas lasting fifteen minutes, followed by normal stool. Tumor: Sausage-shaped, elastic, slightly movable. Visible peristalsis. Operation: Reduced. Ileum into colon. Recovered.

TABLE F.

Chronic Cases With Known Cause.

CASE 245 (Müller, *Arch. f. klin. Chir.*, 1879, xxiv, 183).—Male, age 33. Prior history: Dysentery four months. Onset: Three months, pain and vomiting. Bowels: Irregular, with constipation, becoming absolute. Rectal examination: Blood and mucus. Tumor: Left lower quadrant. Variety: Ileocæcal to rectum. Died.

CASE 246 (Durante, *Bull. de la Soc. Anat.*, 1879).—Male, age 29. Prior history of trauma: Crushed between two wagons. Onset: Sudden, immediate; vomiting. Bowels: Diarrhœa. Rectal examination: Blood. Tumor: Left lower quadrant. Variety: Ileocæcal.

CASE 247 (Rydygier, *Deutsche Zeitschrift f. Chir.*, 1895, xlii, 113).—Female, age 18. Prior history: Ten years ago appendicitis. Onset: Chronic. Operation: Ileocæcal; enterocolic anastomosis. Pathological remarks: Inflammatory stricture of cæcum.

CASE 247a (*Ibid.*).—Male, age 23. Onset: Two months. Operation: Ileocæcal, resection. Died. Pathological remarks. General tuberculosis; invagination began at tuberculous ulcerated stricture.

CASE 248 (Haasler, V. Langenbeck *Arch.*, 1902 Bd. 68, 817).—Female, age 42. Prior history of trauma: Six weeks ago fell from electric car; concussion of brain. Onset: Few days later vomiting (constant), and pain in right lower quadrant. Bowels: Constipation. Tumor: Three weeks; right lower quadrant. Distention. Variety: Ileocolic.

CASE 249 (V. Braman, *Münch. M. Woch.*, 1900, p. 1712).—Male, age 25. Prior history: Family and personal history, tubercular. Onset: First attack ten months ago; colicky pain; attacks more frequent last 3 months; vomiting. Bowels: Diarrhœa. Distention slight; visible peristalsis; tenderness excessive. Operation: Irreducible; coils firmly bound together; resection; enteric. Recovered. Pathological remarks: Probably tubercular.

CASE 250 (Cavaillon, *La Prov. Med.*, 1901, No. 24).—Male, age 46. Prior history with onset: Three weeks; occasional severe pain after eating. Bowels: Alternating diarrhœa and constipation. Rectal examination: No blood. Tumor: In cæcal region, extending into epigastrium. No rigidity; visible peristalsis. Operation: Reduction; ileocæcal to splenic flexure. Pathological remarks: Serosa of cæcum studded with miliary tubercles.

CASE 251 (Quadflieg, *Munch. med. Woch.*, 1901, p. 1093).—Male, age 28. Prior history with onset: Occasional cramps followed by intermittent attacks of acute obstruction for two and a half months, with pain and vomiting. Bowels: stools normal; occasional constipation. Rectal examination: No blood or mucus. Tumor: Size of fist; changeable position, according to pain. Operation: Partial reduction; resection with lateral implantation; ileocæcal to transverse colon. Recovery. Pathological remarks: Broad, deep, circular ulcer in cæcum; cause unknown.

CASE 252.—Male, age 36. Prior history with onset: Typhoid fever one year ago; one attack mild, followed by free interval of six months; latterly constant attacks with vomiting. Bowels: Alternating constipation and diarrhœa. Rectal examination: Mucus; rectum negative. Tumor: Movable, size of fist, to right of navel; disappears with cessation of pain. Abdomen: Distention; tenderness. Operation: Complete resection; ileum to colon by suture. Variety: Ileocæcal to middle of transverse colon. Recovery. Pathological remarks: Ulcer on invagination.

CASE 253 (Maxwell, *St. Barth. Hosp. Rep.*, 1908-1909, 44, 153, 160).—Male, age 28. Prior history: Dysentery for two months. Rectal examination: Mucus and blood. Tumor absent. Retracted abdomen; tenderness over ascending colon. Operation: Irreducible in ascending colon; resection, end-to-end by suture; ileocæcal. Died promptly.

CASE 254 (*Ibid.*).—Male, age 56. Prior history: Dysentery for one month. Rectal examination: Mucus and blood. Tumor absent. Operation: Partially reducible; lateral anastomosis by Murphy button; ileocæcal. Death. Pathological remarks: Seventy-two hours; no tendency to repair.

CASE 255 (*Ibid.*).—Male, age 19. Prior history with onset: Trauma, followed in five days by dysentery. Attack, one month duration; pain severe over tumor. Tumor: Sausage-shaped over curve of colon. Operation: Reduced to size of small orange; then lateral anastomosis by suture. Recovery.

CASE 256 (*Ibid.*).—Male, age 29. Prior history with onset: Four months ago, lump in right upper quadrant, followed by severe pain; no vomiting. Rectal examination: Blood three months ago on two occasions. Tumor: Sausage-shaped over hepatic flexure, could be seen crossing abdomen from right to left with paroxysms of pain. Operation: Irreducible; covered over surface with miliary tubercles; lateral anastomosis; ileocæcal. Recovery. Pathological remarks: Tubercular.

CASE 257 (*Ibid.*).—Male, age 14. Prior history with onset: One month stools small with little blood; eleven days ago pain on right side; vomiting. Bowels: Constipation. Tumor: Indefinite lump over hepatic flexure. Operation: Reduced; lateral anastomosis with suture; ileocæcal. Recovery. Pathological remarks: Miliary tubercles on outside.

CASE 258 (*Ibid.*).—Female, age 13. Prior history with onset: Dysentery for two months; very emaciated. Tumor: Sausage-shaped over transverse colon, with paroxysmal pain. Operation: Reduced with great difficulty, revealing lump in cæcum; excision with lateral implantation;

ileocæcal. Died in four days from peritonitis. Pathological remarks: lump probably tubercular.

CASE 259 (Brin, *Bull. et Mem. Soc. de Chir.*, 1908, 34, 1257-1279).—Male, age 34. Prior history with onset: Three attacks in seven weeks of obstruction with pain and vomiting. Bowels: Bloody diarrhœa. Tumor: In right upper quadrant, disappearing with subsidence of pain. Operation: Reduced; ileocæcal to transverse colon. Recovery. Pathological remarks: Cæcal tuberculosis.

CASE 260 (Schiller, *Beitrag*, xvii, p. 635).—Female, age 35. Prior history with onset: Short, severe attacks of vomiting and colic for nine weeks; between attacks normal. Bowels: Diarrhœa; frequent tenesmus. Rectal examination: Blood and mucus. Sausage-shaped tumor over transverse colon. Operation: Irreducible; resection, with ileocolostomy; ileocæcal. Recovery. Pathological remarks: Ulcer in cæcum.

CASE 261 (Pridmore, *Brit. Med. Jour.*, 1897).—Male, age 40. Prior history with onset: Supposed malaria, then dysentery with abdominal pains. Bowels: Watery and blood-stained stools. Rectal examination: Offensive stools, with blood and pus before death. Sausage-shaped tumor shifting in position; tender. Variety: Ileocæcal. Death. Pathological remarks: Intestine in places gangrenous with old dysenteric ulcers.

CASE 262 (Boyce-Barrow, *Lancet*, 1897, i, 1411).—Male, age 11. Prior history with onset: Attacks of abdominal pain for two months; often vomiting solid food. Bowels: No diarrhœa. Rectal examination: blood and mucus past week. Tumor: Size of hen's egg in right upper quadrant; movable; changeable with pain. Operation: Irreducible; resection, end-to-end with Murphy button; ileocæcal. Recovery. Pathological remarks: Tubercular ulcer at apex of intussusception.

CASE 263 (Orton, *Brit. Med. Jour.*, 1898, i, 489).—Male, age 58. Prior history with onset: For six months pain with offensive stools. Tumor: Soft, doughy mass in right lower quadrant, thought to be feces; diminished by enema. Variety: Jejunum into rectum. Death from exhaustion three and a half years after onset. Pathological remarks: Intussusception irreducible; cæcal segment occupied by ulcerating mass, size of small egg, thought to be inflammatory.

TABLE G.

Meckel's Diverticulum.

CASE 144 (Struthers, *Lancet*, 1906, ii, 1345).—Female, age 5. Onset: Two months abdominal pain; two days repeated vomiting. Rectal examination: Prolapse two months, having at apex (reappearing two days ago) a polypoid mass (appendix, one and a half inches long, inverted). Tumor: Left lower quadrant. Distention. Operation: Ileocæcal reduced; appendix removed through incision in cæcum.

CASE 145 (Bridwell, *Lancet*, 1907, ii, 682-684).—Male, age three and a half. Prior history: Four months before, acute onset with hemorrhage from bowel without known cause. Onset: Five weeks pain and vomiting at intervals. Bowels: Complete constipation. Hard tumor in right

lumbar region and hypochondrium. Rigidity. Operation: Ileocolic from six inches above ileocæcal valve to middle of colon; reduced. Recurrence of pain after one week and two months later. Tumor in umbilical region. At operation an enteric invagination with Meckel's diverticulum at apex. Resection.

CASE 146 (Van Mandach, *Corr. Bl. f. Schw. Aertz*, 1907, 37, 729-732).—Male, age two and a half. Onset: Sudden vomiting. Bowels: Diarrhœa. Tumor in umbilical region. Distention. Operation: Ileocolic reduced; inverted diverticulum reduced itself spontaneously. With reduction several purse string sutures about Meckel's diverticulum to occlude lumen. Cured.

CASE 147 (Kothe, *Deut. m. Woch.*, 1908, 34, 2409).—Male, age 23. Prior history: Six months ago abdominal pain. Onset: Three days acute obstruction; pain and vomiting. Operation: Ileocæcal; partial reduction; resection; end-to-end by Murphy button. Pathological remarks: Meckel's diverticulum inverted at apex.

CASE 148 (Binnie, *Anat. Med. Gaz.*, 1908, 27, 356-358).—Female, age two. Onset: Colic one week, followed by acute obstruction. Tumor: Sausage-shaped; disappeared under anæsthesia. Operation: Transverse colon; resection. Cured. Pathological remarks: Appendix inverted; felt through cæcal wall.

CASE 149 (Delore, *Rev. d. Chir.*, 1908, 38, 39-62).—Male, age six. Prior history: Three or four previous attacks. Onset: Three days, acute. Tumor: Right lower quadrant. Visible coils. Operation: Enteric; irreducible; resection. Death. Pathological remarks: Inverted Meckel's diverticulum.

CASE 150 (Coffey, *ANNALS OF SURGERY*, 1907, xlv, p. 42-48).—Male, age seven. Prior history: At two years severe cramps with vomiting monthly, with bloody stool; at four years similar attack and jaundice. Onset of present attack, acute; pain and vomiting. Bowels: Tenderness of bowel. Rectal examination: Blackberry seeds and later black stool. Tumor: Large in right side. Operation: Ileocæcal; irreducible; resection after opening sheath. Cured. Pathological remarks: Inverted Meckel's diverticulum.

CASE 151 (Moroni, *Virchow. Hirsch. Jahres Bericht.*, 21, 1898, 289).—Male, age 26. Prior history: Operation for ileus; axial torsion. Onset: Recurrent obstruction. Death. Pathological remarks: Complete enteric invagination caused by turning inside out of Meckel's diverticulum, caused by cherry-sized fibrous polyp in Meckel's diverticulum.

CASE 152 (Ryan, *Intercolonial M. J. Austral.*, 1907, xii, 459-461).—Male, age 9. Onset: Acute; pain and vomiting. Operation: Lower iliac (6 inches from ileocæcal valve); resected 12 inches gangrenous gut; ends sutured in wound. Death. Pathological remarks: Starting of intussusception was firm polyp at apex.

CASE 153 (Cheyne, *ANNALS OF SURGERY*, xl, 1904, p. 796).—Male, age 19. Prior history: Two years indefinite abdominal pain. Onset: Nine months acute; vomiting recurrent. Operation: Triple: two reduced; third resected, showed Meckel's diverticulum as cause. Pathological remarks: Mucous membrane greatly prolapsed and hypertrophied.

CASE 154 (Cowardine, *Lancet*, 1904, Feb. 20).—Age fourteen months. Onset: Collapsed. Operation: Double ileal with Meckel's diverticulum. Death. Pathological remarks: Gangrene.

CASE 156 (Robinson, *B. M. J.*, 1899, ii, '1417).—Male, age 5. Onset: Pain and vomiting. Bowels: One stool. Distention; no rigidity; no tenderness; no tumor. Rectal examination: Blood with enema; lump in Douglas's pouch on bimanual examination. Operation: Reduced to inverted Meckel's diverticulum; excision; Lembert suture; enteric four inches long. Death.

CASE 157 (Eve, *B. M. J.*, 1901, ii, 582).—Refers to a case of inverted Meckel's diverticulum without clinical notes.

CASE 158 (Von Stubenrauch, *Cent. f. Ch.*, 1898, No. 26, p. 137).—Female, age 5½. Onset: Acute for five days; vomiting. Tumor: Moderate distention on fifth day; tenderness; sausage-shaped tumor in midline between anterior superior spines. Rectal examination: Blood and mucus; otherwise negative. Operation: Tear during attempted reduction; resection; circular suture; enteric. Death. Pathological remarks: Inverted Meckel's diverticulum at apex of invagination, in gangrenous condition.

CASE 159 (Erdmann, *Annals*, 1900, p. 186).—Male, age 9. Onset: Acute; pain and vomiting. Distention and tenderness; tumor from right iliac fossa to costal margin. Rectal examination: Blood and mucus; tenesmus. Operation: Operation fifty-eight hours after onset; irreducible and gangrenous; resection; end-to-end with Murphy button; enteric to within six inches of cæcum. Death. Pathological remarks: Inverted Meckel's diverticulum at apex.

CASE 160 (Adams, *Tr. Path. Soc.*, London, 1892, p. 75).—Male, age 42. Prior history: Three weeks' duration; obstruction first week; subsidence. Onset: Recurrence with vomiting. Tumor: None; fulness in right lower quadrant. Rectal examination: Blood once with enema. Operation: Ileocolic; gangrenous. Death. Pathological remarks: Inverted Meckel's diverticulum at apex.

CASE 161 (Küttner, *Beitrag*, No. 21, p. 289).—Female, age 49. Prior history: Acute attack eight weeks ago, lasting five days. Onset: Similar attack three days' duration. Operation: Anastomosis between distended and collapsed intestine. Death. Pathological remarks: Meckel's diverticulum intussusception, with three small perforations at base.

CASE 162 (Strauch, *Zeit. f. klin. Med.*, 38, p. 465).—Female, age 6. Prior history: Poor digestion; colic from time to time. Onset: Acute, vomiting. Bowels: Diarrhœa, followed by constipation. Tumor: Hard and elastic, below navel; tenderness. Operation: Reduction partial, then resection; circular suture; enteric. Death. Pathological remarks: Invaginated Meckel's diverticulum.

CASE 163 (Zum Busch, *Cent. f. Chir.*, 1903, p. 733).—Male, age 21. Prior history: Fourteen months dull pain about navel, with alternating constipation and diarrhœa; patient being an athlete, accustomed to holding many men on abdomen. Onset: Acute vomiting. Bowels: Several fluid stools with great tenesmus. Tumor and rigidity in right lower quadrant. Rectal examination: Frequently blood. Operation: Reduction

difficult; gangrenous; resection, side-to-side; "tumor" in intussusception; ileocolic. Recovery. Pathological remarks: Tumor proved an inverted Meckel's diverticulum, with subserous lipoma at apex; abscess in abdominal wall.

CASE 164 (Hohlbeck, *Archives Chir.*, Bd. 61, p. 1).—Male, age 18. Onset: Acute pain and vomiting. Bowels: No gas or stool. Tumor: Sausage-shaped, under anæsthesia in right lower quadrant. Rectal examination: No blood. Operation: Third day; reduction, showing Meckel's diverticulum at apex; resection of Meckel's diverticulum; ileocolic. Died.

CASE 165 (Travers, *Lancet*, 1902, ii, 146).—Male, age 10. Onset: Acute; vomiting. Bowels: Moved; slight tenesmus. Tumor: Over appendix, firm, tender and dull; no tumor in rectum. Rectal examination: No blood, mucus or flatus since primary attack. Operation: Reduction, except Meckel's diverticulum, which was partially reduced, so as not to obstruct gut; ileocolic into ascending colon. Recovery.

CASE 166 (Pitts, *B. M. J.*, 1901, ii, p. 578).—Male, age 15. Prior history: Had eaten pint of cherries. Onset: Pain and vomiting, becoming worse on fifth day. Tumor: None; distention great on fifth day. Rectal examination: No blood or mucus. Operation: Enterostomy; evacuation gas and contents; suture; reduction to inverted Meckel's diverticulum, removed by enterotomy; ileocolic to hepatic flexure. Recovery.

CASE 167 (Dobson, *Lancet*, 1903, i, 1161).—Male, age 4½. Onset: Pain and vomiting. Tumor: In right iliac fossa; soft; mobile. Rectal examination: Blood and mucus. Operation: Reduced to apex, where inverted Meckel's diverticulum projected into gut; resection of Meckel's diverticulum segment, not including mesentery; ileocolic. Recovery. Pathological remarks: No fecal fistula.

CASE 168 (Wainwright, *ANNALS OF SURGERY*, 1902, i).—Male, age 17. Gradual onset of six days; pain and vomiting twenty-four hours. Bowels: Constipation obstinate. No tumor; abdomen retracted; tenderness below. Rectal examination negative. Operation: Thirty-six hours after acute onset; complete reduction, including an inverted Meckel's diverticulum which was removed; enteric, three inches long. Recovery.

CASE 169 (Weil and Frankel, *Soc. Anat.*, 1896, p. 918).—Female, age 4½. Onset: Acute; pain and vomiting thirty-six hours. Bowels: Constipation. Cylindrical, tender tumor over appendix. Rectal examination: Blood. Operation: Reduction; gangrenous; resection; circular suture; ileocolic. Died. Pathological remarks: Meckel's diverticulum at apex.

CASE 170 (Brin, *Bull. Mem. Soc. d. Chir.*, 1908, 34, p. 1267-1279).—Female, age 39. Prior history: Attacks two to three times yearly for twelve years. Onset: During past year, tenderness between attacks. Pelvic tumor, thought to be salpingitis. Operation: Supravaginal hysterectomy; acute obstruction eight days later; reduced; evagination and resection of Meckel's diverticulum; iliac. Recovery. Pathological remarks: Inverted Meckel's diverticulum.

CASE 171 (Riedel, *Deut. Med. W.*, 1909, 1654).—Female, age 25. Onset: Acute pain. Bowels: Constipation; no stool or flatus. No tumor; tenderness over navel; distention slight. Operation: Resection; enteric.

Died. Pathological remarks: Meckel's diverticulum inverted and gangrenous.

CASE 172 (De Quervain, *Cent. f. Ch.*, 1898).—Male, age 16. Onset: Acute; pain and vomiting. Bowels: Several movements; one black stool. No tumor; distention moderate. Rectal examination: Negative. Operation: Resection; fixation of ends in wound; iliac. Died. Pathological remarks: Meckel's diverticulum; inner layers gangrenous.

CASE 173 (Ewald, *Berl. K. W.*, 1897, p. 169).—Female, age 42. Prior history: Repeated attacks of obstruction in seven months. Visible peristalsis. Death sudden, without operation. Pathological remarks: Intussusception of Meckel's diverticulum, with stricture of small intestine and perforation.

CASE 173a (Moore, *Per. communication*).—Twenty-five. Prior history: Several years abdominal colic; diagnosis, appendicitis. Onset: Twenty-four hours; acute. Operation: Reduction; resection of diverticulum; ileocolic. Recovery. Pathological remarks: Bowel dark but not gangrenous; one slight attack of colic since operation.

TABLE H.

Discharge of Necrotic Intussusceptum Per Rectum.

CASE 1 (Catterina, *Clin. Chir.*, 1898).—Female, age 47. Onset: Acute; strangulation. Tumor: Round, oval, size of fist, slightly movable; paraumbilical. Operation: Irreducible invagination; anastomosis with Murphy button. Subsequent discharge of slough.

CASE 2 (Pozza, *Clinica Ch.*, 1901).—Female, age 37. Onset: Sudden; pain right side; vomiting, at length fecal. Rectal examination: Bloody mucus fourth day. Tenderness. Operation: Sixth day; enteroanastomosis, Murphy button. Discharged slough thirteenth day, 60 cm. long. Recovery. Slough consisted of ileum, cæcum and ascending colon; no vermiform appendix.

CASE 3 (Wechsberg, *Cent. f. All. Path.*, etc., 1900, p. 193).—Age, eighteen. Prior history: Acute gastritis; round worms. Onset: signs of peritonitis and fever. Bowels: Discharge of worms not followed by relief. Tumor: Variable position: (a) above navel; (b) right iliac fossa. Tenderness. Operation refused; discharge of slough, composed of cæcum and small intestine in second week. Recovery. End result: Fourteen months later, after several attacks of pain, acute obstruction; death; autopsy showed small intestine terminating in colon below hepatic flexure, with stricture and scars in ascending colon and splenic flexure.

CASE 4 (Schridde, *Münch. Med. Woch.*, Bd. 50).—Female, age 60. Prior history: Tubercular; signs of late stage. Onset: Pain lower right side; vomiting. Bowels: Stool at onset, afterward constipation. Rectal examination: First stool fifth day. Tenderness and distention; visible peristalsis. Discharge of slough on twelfth day; three months later death from acute pulmonary process. Recovery. End result: Autopsy showed annular stricture $36\frac{1}{2}$ cm. above ileocæcal valve; visceral lesions.

CASE 5 (Hallmann, *St. Peter's Med. Wo.*, Bd. 28, 1903).—Male, age 49. Three months ago onset; pain and vomiting, followed by loss of appetite. Bowels: Very fluid stools. Rectal examination: Mucus and blood. Tumor: In left iliac region, disappearing on inflation. Discharge of slough at end of third month. Recovery. Slough consisted of ileum, cæcum and large intestine, with tape-worm still attached.

CASE 6 (Polya, *Owosi Hetilap*, 1905).—Male, age 44. Onset: Sudden; incomplete obstruction. Rectal examination: Tumor protruded from anus. Tumor: Beneath right border ribs. Slough 42 cm. long. Recovery. Cæcum, appendix and ileum. End result: Occasional recurrence of meteorism suddenly relieving itself.

CASE 7 (Hermes, *D. Zeit. für Chir.*, Bd. 77).—Male, age 23. Onset: Sudden; colic; pain on micturition; eight days duration. Distention and tenderness over bladder. Discharge of slough fourteenth day; secondary stricture of rectum cured by artificial anus and subsequent dilation. Recovery.

CASE 8 (Camhours, *Bull. Soc. Anat.*, 1906).—Female, age 23. Prior history: Tubercular family and personal history. Onset: Acute; pain. Bowels: Stools for five days. Rectal examination: Blood. Discharge of slough fifteenth day, consisting of portion of jejunum. Recovery. End result: Persistent distention with painful puffiness one month after discharge of slough.

CASE 9 (Haedke, *Med. Klinik*, 1906).—Age 3½ months. Onset: Acute; vomiting five days' duration. Bowels: Constipation. Rectal examination: Blood; irreducible prolapse. Operation refused; stools recurred; death two days later. End result: "Autopsy showed nature healing as in strangulated hernia."

CASE 10 (Kolbe, *Deut. Med. Woch.*, No. 21).—Male, age 40. Prior history: Dyspepsia, distention, obstipation and hemorrhoids fifteen years. Onset: Three days colic; vomiting. Bowels: Profuse diarrhœa. Rectal examination: Blood and mucus; pus. No rigidity; borborygmi. Discharge of slough 20 cm. long. Recovery. End result: Marked improvement after slough was discharged.

CASE 11 (Solberg, *Norsk. Mag. for Læyrrid*, 1898).—Female, age 30. Onset: Acute obstruction. Discharge of slough fourteenth day. Recovery. End result: Eight weeks later death from second obstruction; no autopsy.

CASE 12 (Segal, *Jeshenêde Vrick*, 1898).—Male, age 56. Prior history: Constipation. Onset: Chronic; pain and frequency of urination. Thirteen days after admission discharge of slough, and two days later a second larger slough. End result: Improvement, followed by opening of abdominal abscess into bladder; persistence of pyuria and granular casts.

CASE 13 (Raven, *I. c.*).—Age 9. Onset: Acute; pain and vomiting. Bowels: Obstipation after primary stool. Distention, tenderness and rigidity. Operation; gangrenous loop; enterostomy; ten days later discharge through fistula of slough. Recovery. End result: Intermittent closure of fecal fistula; death four years later from neglected acute obstruction; autopsy showed almost complete stenosis two feet above valve.

CASE 14 (Chodkiewicz, *Kiel, Inaug. Dissert.*, 1878).—Male, age 20. Prior history with onset: Abdominal pain of long standing. Bowels: Diarrhœa. Rectal examination: Blood and mucus; intermittent. End result: Death after five and a half months; autopsy showed small intestine opening into transverse colon; the discharge of slough was unnoticed.

CASE 15 (O'Connor, *B. Med. J.*, 1894, p. 123).—Male, age 13. Onset: Three days after severe wetting; symptoms of obstruction and peritonitis. Discharge of slough of small intestine, with Meckel's diverticulum on about twelfth day. Recovery. End result: Twelve months after attack patient was well.

CASE 16 (Sutcliffe, *B. Med. J.*, 1894, p. 124).—Male, age 17. Onset: Acute, with symptoms of obstruction and peritonitis for twelve days. Discharge of slough of large intestine on seventeenth day. Recovery. End result: One week after discharge of slough recurrence of symptoms for five days; dysenteric stools persisted forty days.

CASE 17 (Slesser, *Lancet*, 1879, vol. ii, 909).—Age seven months, Onset: Pain. Rectal examination: Blood; dark gray membrane protruding. Tumor: Hardness lower part body. Twelfth day, passed cæcum, part of colon and appendix. Remarks: Well sixteen months; last heard.

CASE 18 (Schmidt, *D. Zeitsch. f. Chir.*, 1898, Bd. 48, p. 83).—Female, age 48. Prior history: Operation (Jan. 3) for carcinoma of stomach; pylorectomy. Onset: January 8; pain and vomiting. Bowels: Diarrhœa; thin, foul mucus. January 27 expelled six-inch section of colon; invaginated. Abscess appeared in upper angle of wound; death February 28; at autopsy stricture in middle of the transverse colon; specimen passed showed that intussusceptum was composed of that part of colon which was freed during the pylorectomy.

CASE 19 (Krabel, *D. Med. Woch.*, 1879, No. 41, p. 525).—Female, age 44. Prior history: Child bed. Onset: Ninth day sudden pain and vomiting (fecal); collapse. Bowels: Constipation; thin diarrhœa. Tumor: Right side. Distention upper part of abdomen; visible peristalsis. Following calomel sudden improvement; bowels moved; later 48 cm. ileum in fair condition passed. Recovery. Pathological remarks: Death later of tuberculosis. Autopsy: 15 cm. above valve Bauhini a strong scar (circular) narrowing lumen of gut but not obstructing it; bowel somewhat dilated above.

CASE 20 (Kofmann, *Centralblatt f. Chirurgie*, 1895, 22, p. 941).—Female, age 22. Onset: Pain and vomiting; sudden. Bowels: Constipation; stool normal in three weeks (following tearing pain in right side), then diarrhœa. Tumor in left side; proved to be abscess; drained. Distention. Eight weeks after onset passed $\frac{1}{4}$ m. bowel. Recovered. Remarks: Recurrence of obstruction symptoms; operation; search of small bowel caused rupture, just below it a stricture (complete) of jejunum thought to be site of intussusception.

CASE 21 (Hampel, *St. Petersburg Med. Woch.*, 1883, Bd. 8, p. 161).—Female, age 43. Prior history: After lifting heavy burden, sudden pain and vomiting. Rectal examination: Blood; rectal mass. Tumor:

Left lower quadrant, movable. Tumor reduced bimanually; hand up to splenic flexure by rectum. Discharge and character of slough: Twenty-second day; 15 cm. bowel passed; ileocæcal with appendix, cæcum and part of ascending colon. Recovery.

CASE 22 (Phelan, *Gaz. d. Hop.*, 1840, 14).—Age 18. Prior history of trauma: Severe blow. Onset: Pain and vomiting for fourteen days. Bowels: Constipation. Tumor: In right lower quadrant.

CASE 23 (Kriz, *Wien. Med. Press*, 1896, 49).—Female, age 38. Prior history: Three days constipation, then normal stool. Onset: Pain and vomiting. Rectal examination: Blood and mucus. No rigidity. Tumor: Smooth, sausage-shape, between hepatic and splenic flexures. Operation: Reduction by massage; recurrence after two weeks; operation refused; slough discharged seventeenth day. Recovery. Remarks: Stools feculant, fluid and foul.

CASE 24 (Parker, *B. M. J.*, 1896, ii, 840).—Male, age 27. Prior history: Colic and constipation; no vomiting. Onset: Gradual increasing pain; one month's duration. Bowels: Alternating diarrhœa. Rectal examination: Blood and mucus. Some distention. Discharge of slough ten to twelve inches long. Recovery. Remarks: After three years of good health death from obstruction in six weeks; invagination in lower descending colon.

CASE 25 (Marchand, *Berl. klin. Woch.*, 1896, 6).—Male, age 14. History of wrestling. Rectal examination: Intermittent blood. Operation: Spontaneous discharge of enteric slough. Death from peritonitis.

CASE 26 (Castelain, *Gaz. Hebdom.*, 1870, No. 20).—Male, age 43. Prior history: Habitual constipation. Onset: Loss of appetite; nausea. Bowels: Constipation. Rectal examination: Blood and mucus; tenesmus. Distention and rigidity: Case mentioned under benign tumor. Fourth week; discharge of large tumor with thin pedicle. Recovery. Pathological remarks: Lipoma.

CASE 27 (Ninans, *Verein d. Aert. in Steiermark*, 1871).—Male, age 32. Prior history: Intermittent attacks of pain for months. Onset: Acute; pain and vomiting for eight days. Bowels: Constipation. Rectal examination: Blood on eighth day. Operation: Twenty-sixth day; discharge of slough. Recovery. Pathological remarks: Intestinal segment has lipomatous polyp; mild obstruction symptom one year afterward; never well since.

CASE 28 (Albrecht, *Peters. M. Woch.*, 1880, No. 9).—Male, age 51. Onset: Pain, followed by diarrhœa. Rectal examination: Mucus and blood. Sixth week; discharge of pedunculated lipoma from large intestine.

CASE 29 (Wallenberg, *Berl. klin. Woch.*, 1864, 437).—Female, age 21. Prior history: History given under malignant growth. Discharge of lower ileum in connection with sarcoma of cæcum.

CASE 30 (Ludloff, *Grenz. Gebiet.*, 1898, 3, p. 600).—Male, age 29. Prior history: Severe colicky pains. Bowels: No stool; no flatus. Rectal examination: Prolapse; invagination at rectum. Distention and tenderness persistent. In a few days discharge of slough, with temporary relief followed by local abscess, which was opened. Recovery.

CASE 31 (Balskow, *Monat. f. Unfall.*, 1905, p. 56).—Male, age 21. Prior history of trauma: Heavy lifting. Onset: Acute; pain and vomiting of six days' duration. Bowels: Constipation. Rectal examination: Mucus; blood on twelfth day. Rigidity and retracted abdomen; tenderness. Operation: Slough discharged on twenty-sixth day, consisting of ileum; cæcum; ascending colon. Recovery.

CASE 32 (Müller, *Strass. Med. Zeit.*, 1909, vi, 45-47).—Male, age 36. Onset: Sudden pain in right lower quadrant; diagnosis, appendix. Bowels: Constipation. Rectal tenesmus. Distention moderate; tenderness general. Discharge of slough with Meckel's diverticulum on it, twenty-first day; probably ileocolic. Died two weeks later from perforative peritonitis.

CASE 33 (Sohlern, *Mitth. aus d. Hamb. Staats.*, Bd. x, No. ii).—Male, age 35. Prior history: Varicose veins five years ago, with operation. Onset: Acute; pain and vomiting. Bowels: After four days no stool or flatus. Rectal examination: Blood and mucus after tenth day, with foul stools. Tenderness general; no visible peristalsis. No tumor. Discharge of slough, twenty-ninth day, containing rusty darning needle; enteric. Recovery. Remarks: Obstruction one month later; operation; stricture near duodenum; death after resection.

CASE 34 (Marnach, *Scot. M. and S. Trans.*, 1906, p. 176-184).—Male, age 3. Onset: Pain. Rectal examination: Blood and mucus; tenesmus. Tumor: In left lower quadrant. Slough passed tenth day. Recovery. Remarks: Well four years after.

CASE 35 (Sohlern, *Mitth. aus d. Hamb. Staats.*, Bd. x, No. ii).—Male, age 18. Prior history: Passage of eighteen round worms failed to relieve pain. Onset: Pain. Tumor: Size of fist in and over centre of abdomen. Slough passed; 4 cm. enteric; 8 cm. colon. Recovery. Pathological remarks: Fifteen months after, death from obstruction, autopsy showing scars in cæcum, splenic flexure and small intestine terminating by narrow orifice in ascending colon 16 cm. above cæcum.

CASE 36 (Kirchner, *Berl. k. W.*, 1886, No. 24).—Infant. After discharge of slough, subsequent complete obliteration developed.

CASE 37 (Wilson, *B. M. J.*, 1910, i, 375).—Male, age 45. Prior history of trauma: Lifting heavy weight; constipation. Onset: Acute; pain and vomiting. Bowels: Diarrhœa and then normal stool. Rectal examination: Blood and mucus after twenty-four hours; rectum negative. Abdomen retracted; tenderness general. Tumor: None. Discharge of transverse colon one week after onset. Recovery.

CASE 38 (Poisson, *Gaz. Med. de Nantes*, 1908, 25, 26, 336).—Female, age 23. Onset: Acute; vomiting and pains forty days ago. Rectal examination: Blood. Tumor: Below and to left of umbilicus. Discharge of slough on fifteenth day. Recovery. Pathological remarks: Early recurrence of obstruction; invagination three feet below pylorus; former invaginated segment makes angle with surface of mesentery; anastomosis between distended and collapsed coils. Recovery.

CASE 39 (Kummer, *Strasb. Med. Zeit.*, 1908, v, p. 180).—Female, age 38. Onset: Acute obstructive symptoms. Bowels: Thin, watery stools,

followed by complete obstruction for two weeks. (Original diagnosis of gallstones.) Discharge of slough on eighteenth day; enteric. Recovery. End result not stated.

CASE 40 (Parker, *Surg. Gyn. and Obst.*, 1908, vii, 358).—Male, age 44. Prior history and onset: Six months continuous pain and vomiting, when he passed 12 inches of small intestine; relief for few weeks, followed by recurrence of symptoms. Operation: Irreducible; resection; lateral implantation; ileocæcal. Recovery. Pathological remarks: Numerous polypi in intestine and a large one at apex of invagination.

CASE 41 (Pullin, *B. M. J.*, 1896, i, 11).—Male, 79. Onset: Attacks of great abdominal pain with distention. Bowels: No flatus with enema. Tumor: To left of umbilicus. Slough passed thirteenth day. Recovery.

CASE 42 (Laurent and Paley, *Bull. Anat.*, 1897, p. 488).—Female, age 33. Onset: Acute; pain and vomiting. Bowels: Constipation. Distention, rigidity and tenderness. Tumor in right lower quadrant. Slough of cæcum and intestine passed on fifteenth day. Recovery. Recurrence of obstruction and death two weeks later.

CASE 43 (Pedrazzini, *Gaz. d. Osp.*, 1897, No. 136).—Male, age 12. Onset: Complete obstruction for eight days. Operation: Passage of slough of small intestine eighth day; enteric. Recovery.

The first 21 cases are described by Raven (*Mitt. aus den Hamb. Staatskr.*, Bd. x, Hft. 1). Other cases, also mentioned by Raven, and credited by him to Braun, Steinmeyer, Sandberg, Hirschsprung, Ayer and Cipriano (vide Bibliography under Raven), could not be traced by the writer and are therefore not included in this paper.

DIVERTICULA OF THE LOWER BOWEL: THEIR DEVELOPMENT AND RELATIONSHIP TO CARCINOMA.

BY LOUIS BLANCHARD WILSON, M.D.,

OF ROCHESTER, MINNESOTA.

UP to the present date, December 1, 1910,* fifteen cases of diverticula of the lower bowel (1 of the cæcum, 12 of the sigmoid, and 2 of the rectum) have been operated upon at the Mayo clinic, St. Mary's Hospital. Four of these cases have proven to be carcinoma apparently arising upon diverticula. In view of the frequency of carcinoma of this portion of the alimentary canal, it is worth our while to enquire whether any pathologic relationship † exists between the two lesions, *i.e.*, diverticulitis and carcinoma.

It has previously been abundantly demonstrated¹ that a very high percentage of gastric carcinomata have their origin in islets of epithelium which have been segregated by scar tissue around the bases of gastric ulcers. Likewise, there is strong presumptive evidence² that primary carcinomata of the tip of the appendix arise in epithelium which has been segregated by obliteration of the lumen of that organ. Is a similar segregation of epithelium present in diverticula of the lower bowel, and, if so, may it furnish the favorable conditions for the development of carcinomata?

Of our 15 cases, nine were males and six females. The oldest patient was 73 years of age, and the youngest 41 years of age, with an average of 55 years. It will thus be seen that all of the patients were in the cancer-bearing period. It is also worthy of note that no clinical case of diverticulitis has been

* Originally read before the Richmond Academy of Medicine, October 25, 1910.

† Our cases will be herein presented from the pathologic standpoint only, a consideration of their clinical aspects being now in preparation by Dr. H. Z. Giffin.

found except in adults. The average duration of symptoms was two and one-half years; the longest period nine years, and the shortest three months. Four of the cases had carcinoma associated with diverticulitis and were clinically diagnosed carcinoma. Of the remaining eleven cases (diverticulitis or peridiverticulitis only) five gave symptoms which warranted a clinical diagnosis of carcinoma. One was diagnosed clinically "ovarian tumor," one "rectal tumor," one "pelvic tumor," one "pelvic peritonitis," one no clinical diagnosis (autopsy), and one was correctly diagnosed diverticulitis of the sigmoid. This record indicates not only the general character of the symptoms but also the extreme difficulty of differentiating clinically simple diverticulitis from carcinoma following diverticulitis, or from primary carcinoma.

The probable cause of diverticula of the colon has been thoroughly discussed in recent literature, summaries of which will be found in articles by Mayo, Wilson, and Giffin,³ Giffin and Wilson,⁴ Barbat,⁵ Abbott,⁶ and Hartwell and Cecil.⁷ It may be stated briefly that diverticula of the lower bowel, while frequently following the course of vessels, probably owe their origin more to congenital weakness of the circumferential muscularis than to any other factor. That they so rarely develop and show inflammatory changes in the young may be due to the fact that the pressure of chronic constipation seems an important element in their development.

It is difficult to say whether or not all of the diverticula are initially true herniæ,—*i.e.*, contain all of the coats of the viscus,—and later become false through their mode of development, as is the opinion of Hartwell and Cecil.⁸ Certainly we have found many colons so defective in both circumferential and longitudinal fibres, that with any considerable pocketing of the wall many areas would have exhibited no muscular coat. In any case it is certain that, as diverticula develop, their coats may become thinned to such an extent that the muscularis, if ever present, becomes imperceptible. This thinning of the walls, particularly of the distal portions, is often so great that one can readily understand how there may be

escape of the bacterial contents of the colon into the subserosa without actual rupture of the mucosa and submucosa. In several diverticula in our cases, this escape of bacterial irritants seems to have taken place without the epithelium within the hernia showing any inflammatory changes whatever (Plate I, Fig. 1). Just outside the submucosa and within the fat of the subserosa is a diffuse infiltration with leucocytes, accompanied, in some instances, with marked increase of fibrous tissue (Plate I, Figs. 2 and 3). At the same time the mucosa in the tip of the diverticulum appears to be perfectly normal (Plate I, Fig. 4). Especially is this so if the lumen of the diverticulum freely opens into the bowel (Plate II, Fig. 9, lower half). This is the condition which I have previously described⁹ as *peridiverticulitis*. It is one which it seems to me it is important to recognize, since any symptoms arising from such an inflammation will be initially present in the peritoneum and not in the colon or diverticulum itself. Of course as an inflammatory tumor mass thus develops in the peritoneal fat close to the bowel, symptoms of obstruction may arise (Plate III, Fig. 12). It is possible that a more careful study of this condition of peridiverticulitis may lead to the recognition of symptoms which will aid in the earlier diagnosis of diverticula.

Whenever a diverticulum becomes impacted with feces, an inflammatory reaction of greater or less extent is set up within it (Plate II, Figs. 7 and 8). When, in addition to such impaction, there exists a greater or less occlusion of the lumen of the diverticulum, the inflammatory process is proportionately increased (Plate II, Figs. 9 and 10). Many diverticula have globular extremities with lumina, which are either very narrow or completely closed off from the lumen of the gut. The mucosa in diverticula of this type is always markedly thinned or entirely absent at the narrowed portions of the lumina, while within the tip it is either degenerating and disintegrating or shows low-grade proliferative changes (Plate II, Fig. 10, and Plate I, Fig. 5). These two types of change in the more or less completely segregated epithelium of the tip of the diverticulum are parallel in all respects with

EXPLANATION OF PLATE I.

Fig. 1, Case IV (19305), $\times 10$ diam.—Longitudinal section through tip of diverticulum passing through muscular coats of sigmoid. The diverticulum has no constriction of its lumen, contains no fecal mass, and has no inflammation in its walls (mucosa and submucosa). Within the fat tissue just beyond the outer end of the diverticulum, however, is a very marked inflammation.

Fig. 2, Case IV (19305), $\times 200$ diam.—Fatty tissue from beyond end of diverticulum shown in Fig. 1. Note infiltration with leucocytes and increase of fibrous connective tissue, the result of chronic inflammation.

Fig. 3, Case II (16736), $\times 7$ diam.—Longitudinal section through tip of a diverticulum from another case, similar to that shown in Fig. 1, but with large amount of fibrous connective tissue *around* the diverticulum in which the mucosa is normal. This specimen contained a large number of diverticula with inflammation only *around* most of them, and presented symptoms leading to a clinical diagnosis of carcinoma.

Fig. 4, Case XII (36504), $\times 15$ diam.—Longitudinal section of tip of diverticulum similar to preceding but of slightly higher magnification.

The sections shown above illustrate what is meant by *peridiverticulitis* as distinguished from *diverticulitis*.

Fig. 5, Case VII (28835), $\times 10$ diam.—Transverse section of tip of diverticulum in which the lumen was obliterated proximal to the point shown. The epithelium is here proliferating but has not invaded its submucosa. The specimen contained one diverticulum with fairly normal mucosa in its tip (Plate II, Fig. 8), and others almost obliterated by carcinoma (Plate III, Fig. 13).

Fig. 6, Case VI (21699), $\times 10$ diam.—Longitudinal section of diverticulum, within the wall of which is well-developed carcinoma. The gross appearance of this specimen is shown in Plate III, Fig. 14.

PLATE I.

FIG. 1.

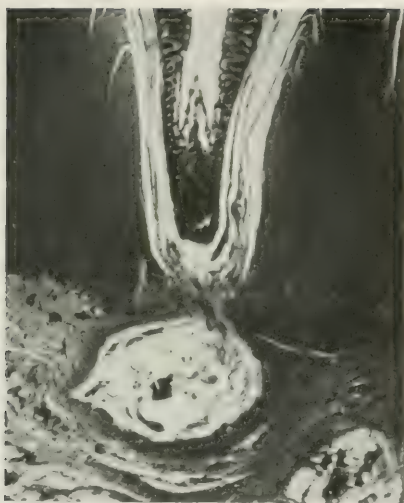


FIG. 2.

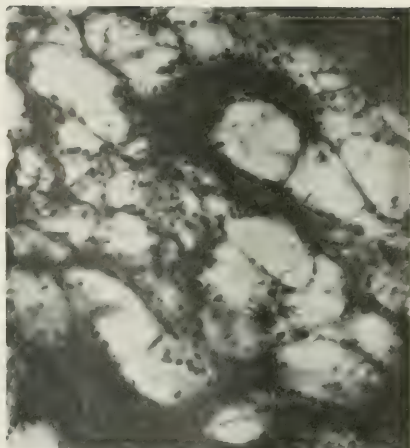


FIG. 3.

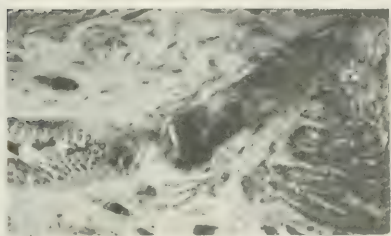


FIG. 4.

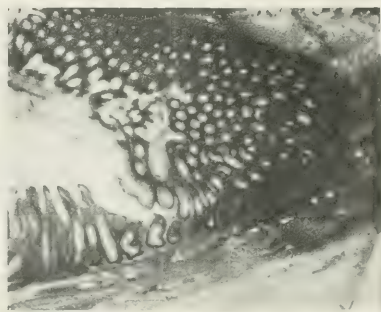
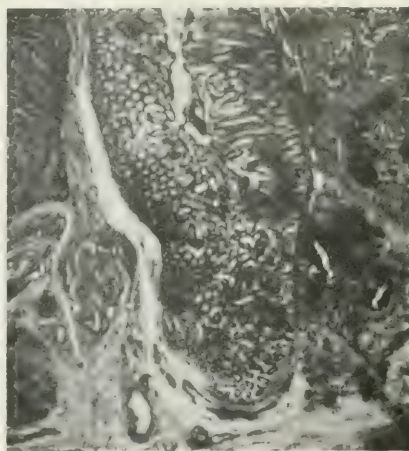
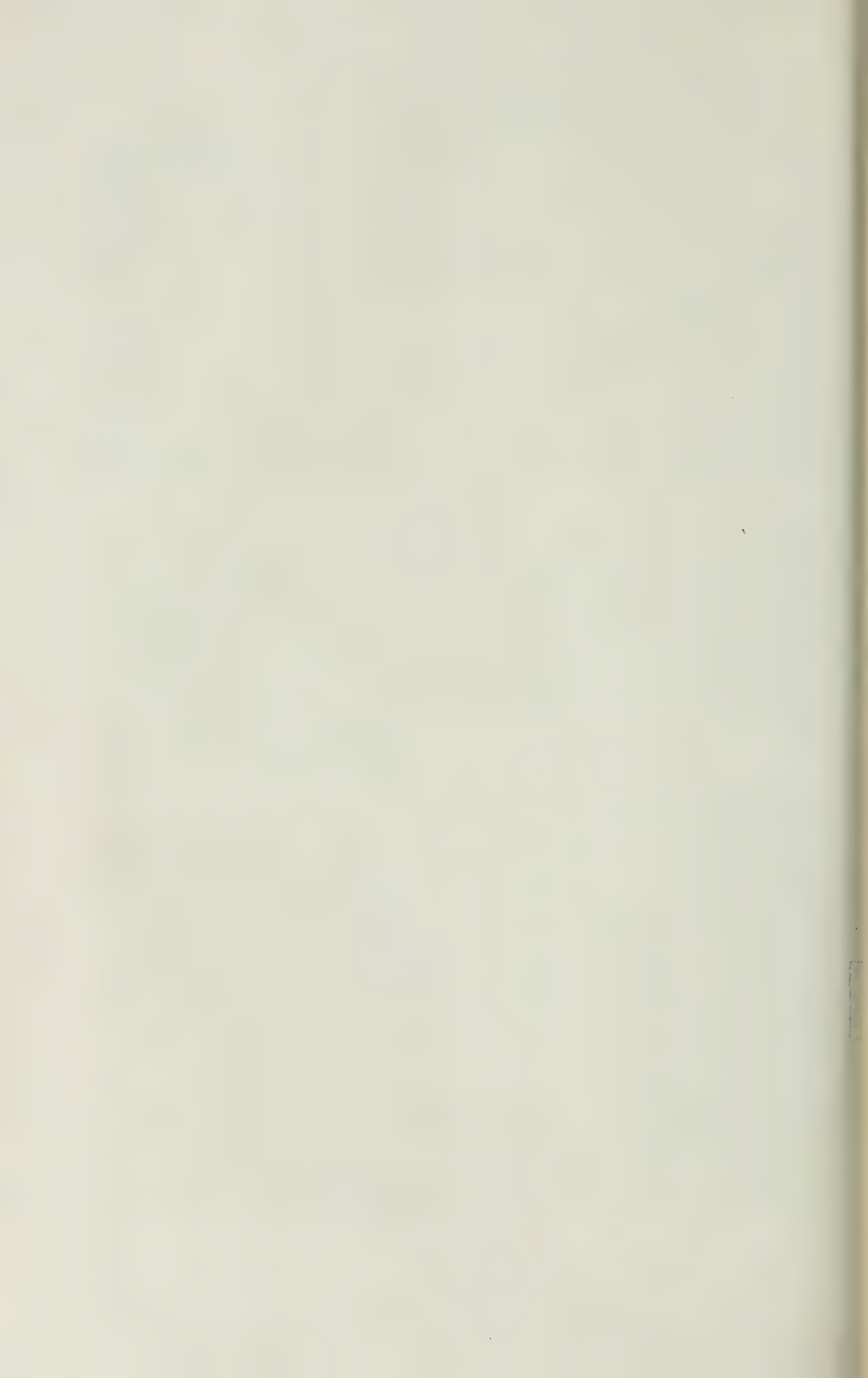


FIG. 5.



FIG. 6.





the cell changes which occur in masses of epithelium segregated about the base of the gastric ulcer. In other words, it appears that if the segregated epithelium has its blood supply materially reduced it degenerates and disintegrates. If, on the other hand, its blood supply is not materially interfered with it proliferates. This proliferation usually takes the form only of an increase in the number and size of the cells without any invasion of the basic connective tissue.

It seems to be but a very short step, indeed, from such an epithelial proliferation crowding the entire diverticulum, to the infiltration of its walls, thus forming a histologic picture which must be diagnosed as carcinoma (Plate I, Fig. 6).

Four of our cases of diverticulitis have well-advanced carcinomata developed on diverticula, though the latter are still unmistakable. Unfortunately we have found no very early carcinoma, and must confine our observations to the recently developing portions of old carcinomata in the cases at hand. In each of these, however, there are either diverticula which contain no carcinoma or diverticula which have only a very small portion of their walls carcinomatous (Case VII, Figs. 5, 8, and 13; also Case VI, Figs. 6 and 14). In all three of these there thus seems to be little doubt but that the carcinomata have developed on previously existing diverticula and have arisen therein from the epithelium which was previously segregated by inflammatory tissue.

The probable percentage relationship of carcinomata of the cæcum, sigmoid, and rectum to previously existing diverticula can at present only be conjectured. I am convinced that a great many cases, however, do so arise. Further, it seems probable that many cases of carcinoma of these areas, which still contain unmistakable remains of diverticula, have in the past been overlooked by surgeons and pathologists. The best time for the discovery of diverticular remains in carcinomata of the colon is immediately after the removal of the tissue from the body. If a glass probe with a bulbous point one millimetre or less in diameter be used very gently in the large pits of the cauliflower surface of a freshly removed carcinoma, which is

EXPLANATION OF PLATE II.

Fig. 7, Case XV (38021), $\times 1$ diam.—Two excised diverticula of the sigmoid (considerably shrunk by fixation). The one to the left still contains its fecal concretion. An inflammatory tumor mass surrounded the diverticula. This was palpable clinically and led to a diagnosis of carcinoma (patient's age 73 years) by several skilful diagnosticians.

Fig. 8, Case VII (28835), $\times 2$ diam.—Clear diverticulum in case of carcinoma of the sigmoid, shown in Plate III, Fig. 13.

Fig. 9, Case IV (19305), $\times 2\frac{1}{2}$ diam.—Two diverticula of sigmoid. In the lower the lumen is wide open and there is little inflammation, either within or around it. In the upper the lumen is much constricted, a fecal mass lies in the pouched tip, and the mucosa and the surrounding fatty tissue both show marked inflammatory changes.

Fig. 10, Case I (41903), $\times 3\frac{1}{2}$ diam.—Diverticulum with lumen completely obliterated. Epithelium of tip proliferating.

Fig. 11, Case XII (36504), $\times \frac{1}{3}$ diam.—Sigmoid containing two diverticula which are indicated by rubber-covered glass probes. Specimen shows the difficulty of finding the evidence of diverticula with the sigmoidoscope.

PLATE II.

FIG. 7.

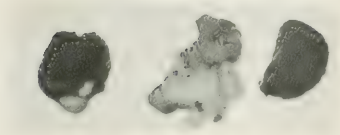


FIG. 9.



FIG. 8.

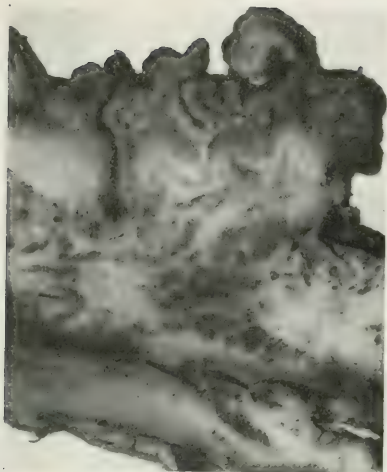


FIG. 10.

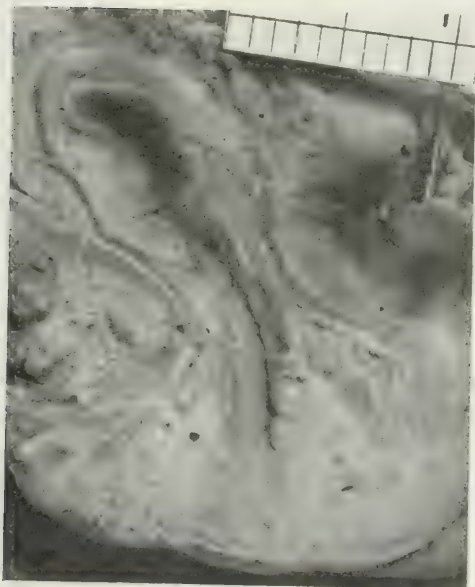
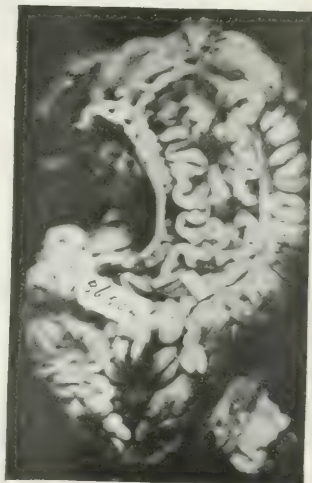
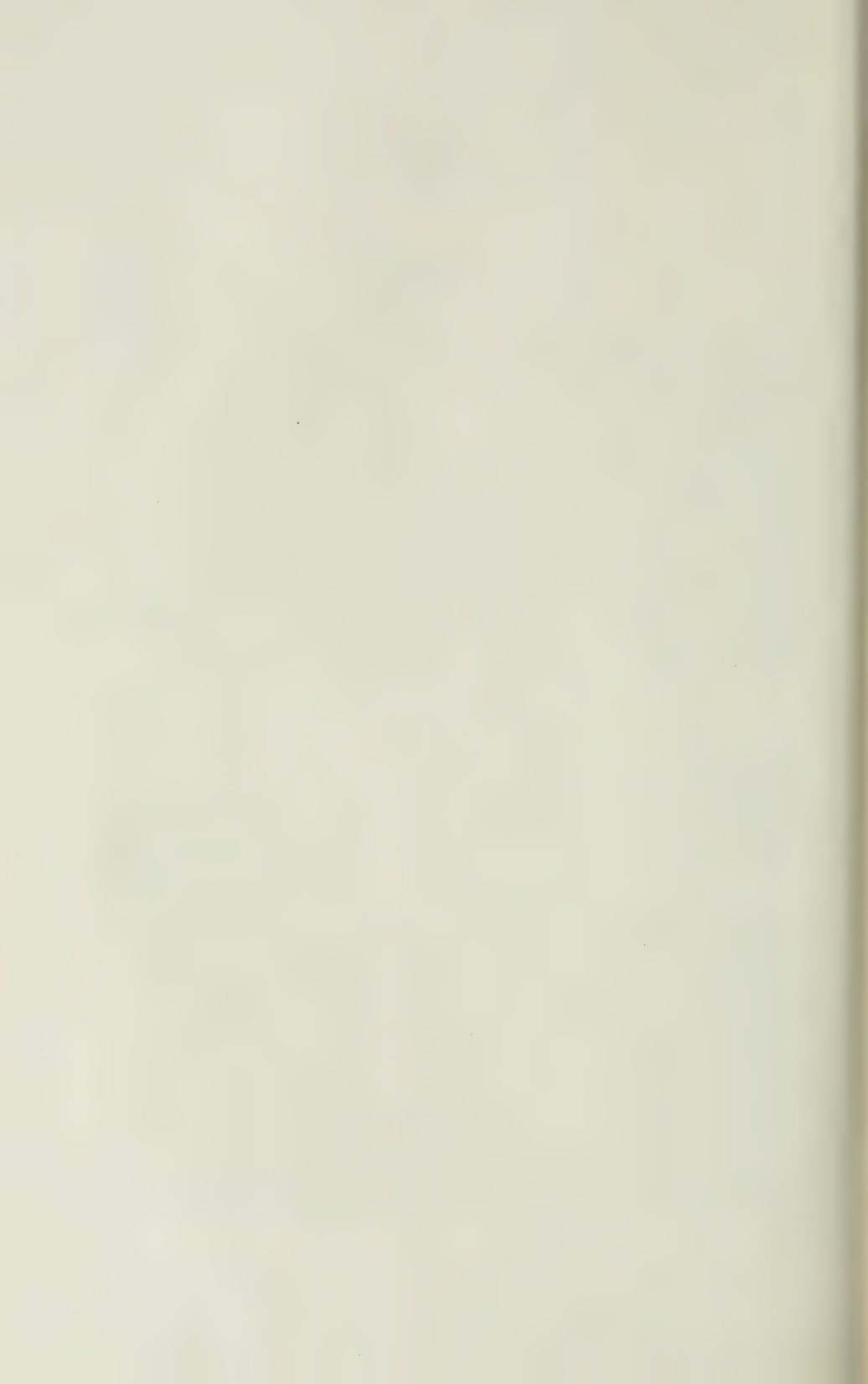


FIG. 11.





not badly ulcerated, there is a fair chance of discovering any existing diverticula without destroying their mucosa (Plate II, Fig. 11). When diverticula are suggested by the probe slipping deeply into the tumor, they may be more perfectly demonstrated by slicing the tumor mass into thin layers parallel with the surface of the bowel and beginning on the peritoneal side (Plate III, Figs. 15 and 16). This method may also be employed with good effect in hardened specimens, though it will here require the utmost care to determine the presence of small calibred diverticula. When a diverticulum is thus unmistakably demonstrated, it is best studied by a section parallel with its lumen and with the long diameter of the bowel. The adoption of some such method of examination as above indicated as a routine examination, especially of fresh tissues, will, I believe, undoubtedly result in the discovery of diverticular remains in a very large percentage of relatively recently developed carcinomata of the cæcum, sigmoid, and rectum, and it seems probable that before very long some one will have the pleasure of discovering a carcinoma in a very early stage of development from the segregated mucosa of a diverticulum. In thus calling attention to the importance of recognizing segregated epithelium as a point of least resistance for the development of carcinomata, I wish to disclaim any intention to eliminate other agents as essential etiological factors in the genesis of tumors.

SUMMARY.

1. Fifteen cases of diverticula of the lower bowel have been studied to date, December 1, 1910.
2. Three of these were cases of *peridiverticulitis*. In these the inflammation did not involve the mucosa. Its presence in the peridiverticular fat was apparently due to leakage through the thin-walled diverticula—a condition similar to that met with in old umbilical herniæ. Their symptoms were those of peritonitis or obstruction from pressure.
3. In four cases carcinomata had developed in the diverticula, probably from epithelium segregated by chronic inflammation.

EXPLANATION OF PLATE III.

Fig. 12, Case XIV (37503), $\times \frac{1}{2}$ diam.—Transverse section through wall of sigmoid showing diverticulum (at left) and large inflammatory mass external to it.

Fig. 13, Case VII (28835), $\times \frac{3}{8}$ diam.—Longitudinal section through sigmoidal wall, showing carcinoma containing remains of diverticulum. See also Fig. 5, Plate I, and Fig. 8, Plate II, for sections of other diverticula from same case.

Fig. 14, Case VI (21699), $\times \frac{2}{3}$ diam.—Transverse section of sigmoid, showing gross appearance of carcinoma mass and its contained diverticulum, which is shown magnified in Plate I, Fig. 6.

Fig. 15, Case X (35351), $\times \frac{2}{3}$ diam.—Section parallel with and close to outer surface of tumor mass in case of carcinoma of the rectum. The transverse sections of the tips of two diverticula are seen close together near the centre of the photograph. The picture illustrates the plan suggested in the text for searching for diverticula in carcinomata of the lower bowel.

Fig. 16, Case X (35351), $\times \frac{2}{3}$ diam.—Longitudinal section through wall of rectum at right angles to the section shown in Fig. 15 and opening longitudinally, for a considerable portion of their length, the two diverticula shown in Fig. 15. At the right is seen in section the large "cauliflower" carcinoma which had its origin within the diverticula, and which, as it developed, so distorted and filled their lumina that their openings were missed when probing from the mucosal side of the tumor.

PLATE III.

FIG. 12.

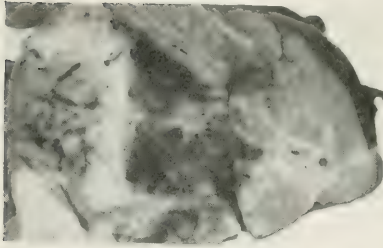


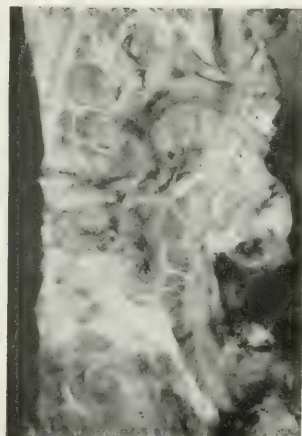
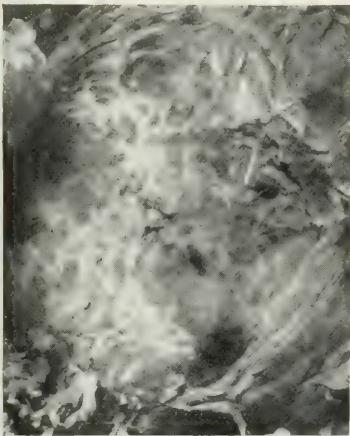
FIG. 13.

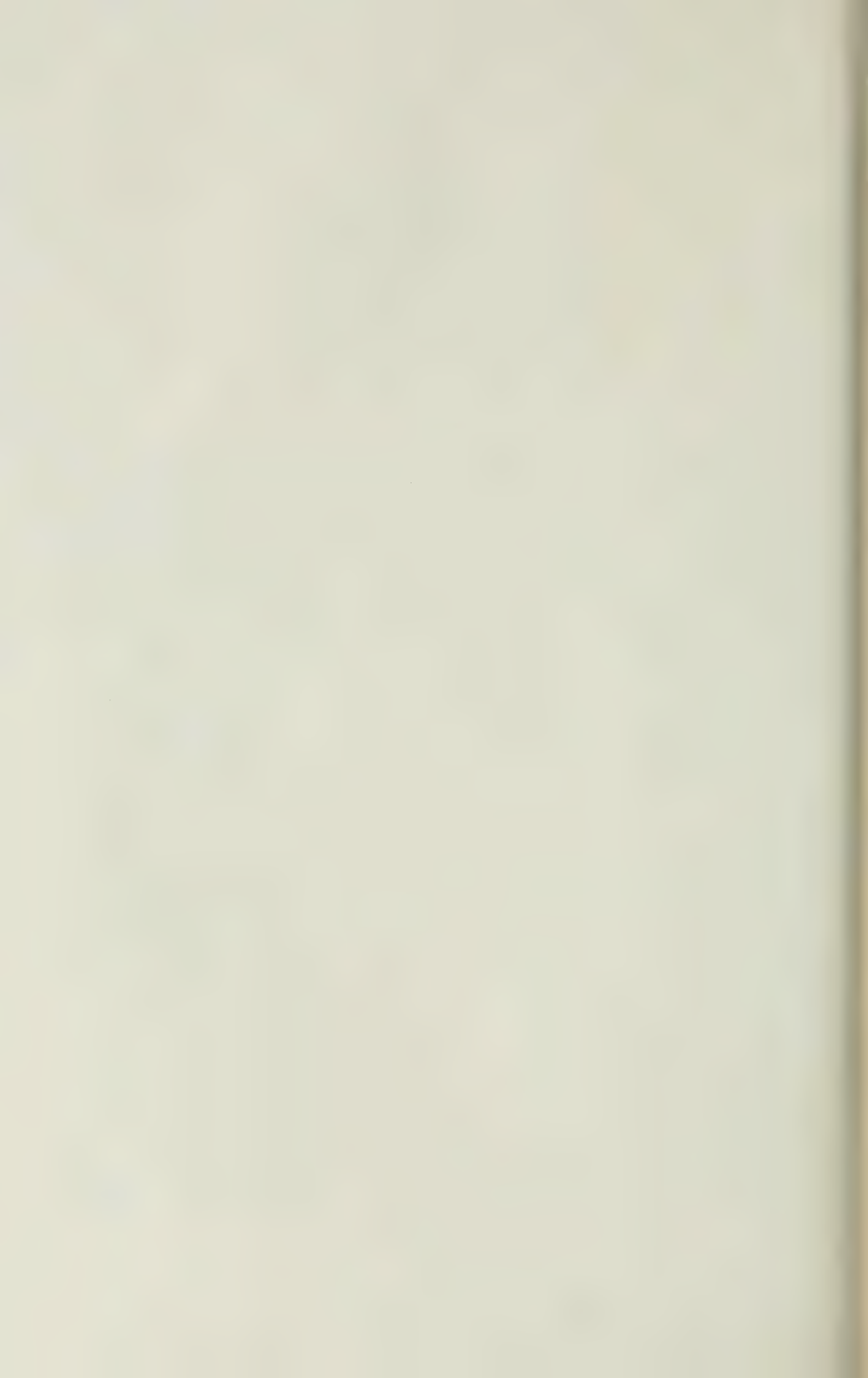
FIG. 14.



FIG. 15.

FIG. 16.





REFERENCES.

- ¹ Wilson and MacCarty: American Journal of Medical Sciences, Dec., 1909, vol. cxxxviii, pp. 846-852.
- ² Wilson: Journal American Medical Association, Sept. 10, 1910, vol. lv, pp. 921-923. MacCarty: *Ibid.*, Aug. 6, 1910, vol. lv, pp. 488-491.
- ³ Mayo, Wilson and Giffin: Surgery, Gynæcology, and Obstetrics, July, 1907, vol. v, pp. 8-15; Trans. American Surg. Assn., 1907, pp. 240-244.
- ⁴ Giffin and Wilson: American Journal of Medical Sciences, Nov., 1909, vol. cxxxviii, pp. 661-666.
- ⁵ Barbat: Surgery, Gynæcology, and Obstetrics, March, 1910, vol. x, pp. 295-299.
- ⁶ Abbott: Journal of the Minnesota State Medical Association, March, 1910, vol. xxx, pp. 118-119.
- ⁷ Hartwell and Cecil: American Journal of Medical Sciences, Aug., 1910, vol. cxi, pp. 174-203.
- ⁸ Hartwell and Cecil: *Loc. cit.*
- ⁹ *Loc. cit.*, Ref. No. 5, p. 9.

ON THE COINCIDENCE OF VOLVULUS AND REAL OR SIMULATED STRANGULATED HERNIA.

BY ROBERT T. MILLER, JR., M.D.,

OF PITTSBURGH, PA.,

Surgeon to St. Francis Hospital.

STRANGULATED hernia remained for years one of the most formidable surgical problems. Within the more recent time its management has been freed of the major difficulties, a fact which has been brought about largely by the development of a clearer conception of the pathological process, more accurate and earlier diagnosis, the substitution of regional in place of general anæsthesia, and, finally, improvement in the therapy instituted in the presence of gangrenous gut. So complete has been the development that at present the problem is considered commonplace. It may be truly said that there is to-day no general realization of the frequent and formidable variations from the type case; and it is just as true that these variations, escaping recognition, are contributing heavily to our mortality.

Late years have brought an increasing number of reports of two interesting complications of the strangulation of herniated bowel, viz.: (1) the coincidence of volvulus, and (2) so-called retrograde incarceration.¹ One has but to pursue the recent literature, sparse as it is, perhaps, to become convinced that at the present time these conditions are more common than supposed and are frequently the explanation of unexpected fatality following an apparently satisfactory operation.

In a two-fold endeavor to draw attention to the association of volvulus with actual or simulated strangulated hernia and to contribute to its study, the writer presents two cases

¹ Involvement in nutritional changes of the intra-abdominal "joining loop" between two strangulated loops.

recently occurring in his service at St. Francis Hospital, together with abstracts of the cases reported since Knaggs's paper in this JOURNAL in 1900. By a collective study of these cases attempt is made to bring out certain important diagnostic features which are of established value.

CASE I.—Symptoms of acute intestinal obstruction accompanied by signs of strangulated inguinal hernia. Operation. Volvulus of ileum, one loop of which incarcerated in hernia sac. Reduction of volvulus. Death. Autopsy.

H. M., male, colored, aged 63 years, laborer. Patient was admitted June 5, 1910, at 4 P.M., with a history of strangulation of a right inguinal hernia for the previous nine hours, accompanied by the typical picture of vomiting, absolute constipation, and pain about the rupture. The hernia had been present for years. Upon examination the patient was found to be a well-developed man of large frame. He was decidedly shocked and suffering acutely with pain about the hernia and over the abdomen. Surface temperature was markedly reduced, his face and hands were cyanotic, cold, and clammy, and his facial expression was one of extreme anxiety. There was a right inguinal hernia presenting as a moderately tender, tympanitic mass about the size of one's fist and occupying most of the scrotum. The abdomen was considerably distended, symmetrical, and generally tympanitic. Palpation was negative. Peristalsis was not visible. His pulse was weak, 100 to the minute. Leucocytes 14,000. Temperature not recorded.

The examiner was impressed with the extreme degree of shock which seemed quite out of proportion to the local signs about the hernia, but in spite of this made a diagnosis of strangulated hernia containing bowel. Immediate operation was proposed and accepted.

Operation.—Morphia, gr. $\frac{1}{8}$, was given hypodermically and anæsthesia maintained throughout the operation by the local injection of novocaine solution 0.5 per cent. The sac of an acquired indirect right inguinal hernia was opened and found to contain a considerable quantity of foul-smelling, turbid fluid, together with an cedematous, dark-blue loop of greatly distended small bowel about ten inches in length. Both the gut and its mesentery showed numerous ecchymoses. After division of

the constriction, which occurred at the internal ring, there was found a fairly well-marked compression ring on each limb of the loop; up to this time it was thought that we were dealing solely with a strangulated hernia containing bowel. The gut was now drawn out of the abdomen to facilitate examination of the supposedly strangulated loop, whereupon it was discovered that the proximal bowel above the hernia presented exactly the same dark-blue ecchymotic appearance. Attempt was then made to draw out the distal loop, but this was found to be firmly held within the abdomen and could not be dislodged. The finger introduced into the abdomen met with a hard mass just inside of the internal ring. The condition evidently demanded exploration, and the incision was accordingly enlarged, whereupon a considerable quantity of thin bloody fluid escaped from the abdomen. It was then possible to draw out the cyanotic proximal loop up to the point of its abrupt transition into normal though distended bowel; from this transition point distally for a distance of two or three feet the bowel presented uniformly the same dark-blue appearance as that of the loop originally found in the hernia sac and finally passed beneath a taut band of tightly twisted mesentery. The condition was then immediately recognized as a volvulus, and the whole mass grasped and rotated 360° in a direction opposite to the hands of a clock, whereupon the distal loop was freed and could be readily followed to the cæcum, about three inches of normal bowel intervening between the lower limit of the volvulus and the cæcum. This manœuvre plainly restored normal relations.

The twisted loop was of very questionable viability but had a definite mesenteric pulse and, inasmuch as the patient's condition was so urgent as to absolutely exclude a successful enterectomy, the bowel was drained of a considerable quantity of foul bloody fluid through a stab wound which was then immediately closed by suture, the bowel replaced in the abdomen, and the wound hurriedly closed about three small drains to the suture line.

The patient died seventeen hours after operation, having passed during this time three copious, bloody, fluid stools.

Autopsy revealed a perfectly black gangrenous loop of bowel about thirty inches in length, terminating below at a point three inches above the ileocæcal valve. The mesentery of this gan-

grenous loop was greatly lengthened and thickened, being quite evidently the site of old as well as recent inflammatory changes. The mesenteric vessels supplying this loop were thrombosed—both veins and arteries. Intra-abdominal conditions were otherwise normal, there being no point of intestinal obstruction. One could readily reproduce the volvulus, whereupon the observations made at operation were confirmed. Further autopsy findings had no bearing on the case other than as showing general senile changes.

CASE II.—*Symptoms of acute intestinal obstruction, accompanied by signs of strangulated inguinal hernia. Operation. Intrahernial volvulus of cæcum, loop of ileum, and appendix. Intra-abdominal obstruction of the oral bowel apparently due to a second volvulus. Restoration of normal relations. Recovery.*

A. R., male, white, aged 72 years, laborer. A fleshy man of large frame with marked general arteriosclerosis, myocarditis, and emphysema. There was an enormous right indirect inguinal hernia reaching half way to the knees; this hernia had been present for years and had always been reducible, though with increasing difficulty during the past year. Attempted reduction at the time of admission was painful and not persisted in, since the hernia was causing no symptoms. He was admitted on account of a varicose ulcer upon the right lower leg, and was put to bed and the leg elevated. His bowels did not move very freely, and he received upon the evening of the fifth day after admission two compound cathartic pills. At 10 A.M. of the sixth day, while at stool for the second time, the patient complained of sudden pain in the hernia, which he felt "come down" and which reached a larger size than ever before. "Crampy" pain soon appeared and was followed an hour after onset by vomiting; an hour later general abdominal "crampy" pain became severer and the patient vomited a second time.

Upon examination the hernia was found to have attained enormous proportions; it was very tense, somewhat tender, and tympanitic over its lower pole. The abdomen was not distended but was generally tender. There was no visible peristalsis. Attempts to reduce the hernia were futile. Within an hour after the first pain the patient showed extreme shock; his face was drawn and ashy in appearance, lips pale, hands cold, pulse 84 to the minute and irregular, temperature 97.2°. Leucocytes

18,600. His appearance was very striking and, as in Case I, the disproportion between the degree of shock and the amount of change in the hernia was pronounced. A diagnosis of strangulated hernia was made, however, and immediately operation proposed.

Operation.—Under local anæsthesia the hernia sac was opened within three hours after the onset of symptoms. The sac contained some turbid fluid together with the cæcum, appendix, and a short loop of ileum, all three of which were moderately cyanotic and œdematous. The posterior surface of the cæcum presented anteriorly, the ileocæcal valve being situated upon its external lateral aspect, the ileum passing behind it and to the right, the appendix emerging from behind the cæcum to pass lower into the sac; the herniated bowel had evidently rotated 180° from the right posteriorly to the left, producing an intrahernial volvulus. There was little sign of strangulation of this twisted bowel, but it is to be noted that symptoms had been present only three hours. Rotation 180° from the left posteriorly to the right easily untwisted the gut. The mesocæcum was rather voluminous, and the wall of all the herniated bowel was thickened by a chronic rather than an acute inflammatory process, which gave one the impression that this bowel had frequently if not always assumed this twist of 180° when occupying the hernia sac.

The neck of the sac was now examined and found widely patent, there being no evidence of constriction at this point. Furthermore, neither upon oral or aboral limb of the herniated loop was there found a compression ring. The bowel proximal to the herniated loop was pulled out and found not especially distended. These findings disproved the diagnosis; exploration was evidently demanded, and the incision accordingly enlarged. The proximal bowel was now further drawn out by gentle traction; during this process it was felt suddenly to give as though released from some intra-abdominal constriction, after which it extruded itself into the wound without help. Its appearance was striking. A loop of small bowel 32 inches in length was greatly distended, œdematous, and very cyanotic, showing numerous ecchymoses in its wall and mesentery; proximally and distally this loop terminated abruptly, its lower limit being situated 20 inches above its ileocæcal valve. Between this loop and the herniated portion of the ileum, there intervened four inches

of normal collapsed bowel. There did not seem to be a marked degree of distention above this loop. It was quite evident that this cyanotic loop had been the site of intra-abdominal strangulation, the exact nature of which could not be investigated because of the patient's urgent condition.

There seemed two possibilities, viz.: torsion of this loop or its knuckling over the taut mesentery of the herniated bowel, this latter being much the least probable, inasmuch as this mesentery was not found tensely stretched when the sac was opened, nor did the cæcum and adjoining ileum exhibit circulatory changes indicative of such stretching.

In spite of the patient's unpromising condition, chloroform anæsthesia became necessary to make possible the return of the bowel to the abdomen, and the wound was hurriedly closed. The patient gradually reacted under active stimulation, and subsequently had a slow but uninterrupted convalescence.

These two cases represent a clinical group whose importance and study are at present exciting attention. An occasional case has found its way into print from time to time, but it is only within recent years that there has begun a systematic study which is bringing an increasing number of reports of individual cases, and which, it is to be hoped, will add to our means of diagnosis. There can be no question but that the combination of some type of internal strangulation with real or simulated strangulated hernia is of more frequent occurrence than at present appreciated. There are numerous reported cases in which, after an apparently satisfactory operation for strangulated hernia, autopsy has revealed a second intra-abdominal strangulation, and we may hence reasonably infer a certain number of such cases where failure to make a post-mortem examination has allowed the surgeon to take refuge in such unconfirmed diagnoses as shock, intestinal paresis, or peritonitis.

The clinical picture is a fairly definite one. An individual, generally well past middle life, sickens suddenly with all the signs of intestinal obstruction, accompanied by more or less marked pain, tenderness, and increase in size in a long-standing

hernia. Abdominal tenderness may be present but is generally overlooked, since the rupture dominates the scene. The hernia may be readily reduced by taxis, or, more frequently, open operation reveals an incarcerated or strangulated loop of bowel which the operator disposes of to his entire satisfaction. After operation, the patient continues to vomit, constipation persists, the symptoms of obstruction become more violent and soon eventuate in death. Autopsy reveals a second unsuspected intra-abdominal lesion, volvulus being of frequent occurrence, though there have also been found the other types of internal strangulation, a slowly stenosing neoplasm of the large bowel (Hochenegg), and even general peritonitis (Clairmont).

It is especially with the coincidence of volvulus and hernia that this paper deals. The group is a large one, including both simulated and actual hernia. The dominant feature is always acute intestinal obstruction. Strangulated hernia may be complicated by volvulus of an intra-abdominal oral loop; there may be a volvulus, one loop of which finds its way into the hernia sac to become incarcerated and simulate strangulation or to become actually strangulated, or, again, the torsion may occur within or just above the neck of the sac, when both factors may contribute simultaneously to the production of strangulation within the hernia sac. The group thus presents a complicated picture. Knaggs, in 1900, proposed four groups, viz.:

Group I: Volvulus of a portion or all of the herniated bowel.

Group II: Volvulus of the small bowel, one loop of which becomes herniated.

Group V: Volvulus of the herniated bowel immediately after its reduction.

Group VI: Volvulus of the herniated bowel long after its reduction.

Two additional groups must now be added, viz.:

Group III: Volvulus of a distant oral loop above an actually strangulated hernia.

Group IV: Volvulus, generally of the large bowel, distal to a simulated strangulated hernia.

There follow the abstracts of the collected cases, all of which, with one or two exceptions, have appeared since 1900.

GROUP I.—*Volvulus of a portion or all of the herniated bowel.*

1. STEWART (*ANNALS OF SURGERY*, vol. xxxiv, p. 316).—Male, aged 50 years. Right inguinal hernia present 8 years. Symptoms of strangulation 2 days. Sac contained one foot of ileum twisted 130° from right to left. Recovery. “. . . patient presented evidence of peritonism out of all proportion to the condition found at operation.”

2. ERDMAN (*ANNALS OF SURGERY*, vol. xxxiii, p. 203).—Female. Strangulated ventral hernia. “. . . complete torsion of the coil of intestine which filled the hernia sac.” Excision of 12 inches of bowel. Recovery.

3. KOERBER (*Deutsche Zeitschrift für Chirurgie*, vol. lxxxix, p. 249, 1907).—Female, aged 62 years. No previous history of hernia. Strangulated about 12 hours. Right inguinal hernia sac contained 16–18 cm. small bowel twisted 180° , vessels of mesentery thrombosed, and extensive retrograde mesenteric thrombosis. Resection. Recovery.

4. KLAUBER (*Münchener medicinische Wochenschrift*, 1907, p. 1986; quoted from Clairmont, Langenbeck's *Archiv für klinische Chirurgie*, vol. lxxxviii, p. 631, 1908).—Hernia strangulated 24 hours. Findings: loop of small bowel twisted 180° just above neck of sac. Reduction of torsion. Recovery. Note: taut mesentery palpated through internal ring.

5. KNAGGS (*Lancet*, 1900, p. 1726; quoted from Clairmont, *Ibid.*).—Female, aged 61 years. Femoral hernia, strangulated for 6 days. Sac contained a gangrenous loop which was twisted 180° right to left just above neck of sac. Resection. Death.

6. CLAIRMONT (*Ibid.*).—Male, aged 75 years. Right inguinal hernia for 50 years. Symptoms of strangulation for over 12 hours. Contents reduced unexpectedly at operation before sac was opened. Closure without exploration. Death on fourth day. Autopsy: volvulus of necrotic loop formerly in hernia sac.

7. DOBSON (*The Lancet*, March 6, 1909, p. 679).—Male, aged 68 years. Right inguinal hernia for years. Symptoms of strangulation for 24 hours. Operation: volvulus of 2 or 3 feet of small bowel through 360° ; some loops of volvulus in hernia sac but not strangulated.

8, 9, 10. BRZOSOWSKI (*Chirurgie*, Bd. xix, Nr. III, Russian; abstract in *Zentralblatt für Chirurgie*, vol. xxxvii, No. 9, p. 254).—Three cases. In each case part of hernial contents involved in a volvulus of 180° – 270° from right forward to left. “Irreducible hernia, which though exaggerated distention of a loop, simulates incarceration.”

11–17. KNAGGS (seven cases reported in 1900).—Male, 4; female, 2; not stated, 1. Average age, 58 years. Average duration of hernia, 26 years. Inguinal hernia, 5; femoral hernia, 1; duodenal hernia, 1. Bowel in hernia sac gangrenous in 2 cases. Four deaths.

SUMMARY OF GROUP I.—Cases, 17. Male, 7; female, 5; unknown, 5. Average age, 61 years. Average duration of hernia, 27 years. Type of hernia: inguinal 9; right 6, left 2, not stated 1; femoral, left 1, not stated 1; umbilical 1; duodenal 1; type not stated, 4. Recovery, 7. Death, 6. Result not stated, 4.

GROUP II.—*Volvulus of the small bowel, one loop of the volvulus occupying the hernia sac.*

1. MILLER.—The writer's Case I.

2. KNAGGS (*The Lancet*, March 6, 1909, p. 676).—Male, aged 60 years. Left inguinal hernia 20 years. Symptoms of strangulation 13 hours. Sac contained 2 feet of congested small bowel with hemorrhagic mesentery. Compression rings on bowel well marked. Autopsy on sixth day: volvulus left to right of 6 to 8 feet of ileum, which showed definite but not excessive circulatory changes, excepting that loop formerly occupying the hernia sac, which was gangrenous.

3. KNAGGS (*Ibid.*).—Male, aged 62 years. Right inguinal hernia 11 years. Symptoms of strangulation 6 to 10 hours. Sac contained 18 inches of congested ecchymotic ileum. Ring loose. No compression rings on bowel. Volvulus right to left 180°, 4 feet of ileum. Recovery.

4. KNAGGS (*Ibid.*).—Male, aged 41 years. Left inguinal hernia 4 years. Symptoms of strangulation 2 to 3 days. Sac contained 12 inches of dark-red ileum. Neck of sac not constricted. No compression rings on bowel. Volvulus of about 2 feet ileum, 180° right to left. Recovery.

5. DOBSON (*The Lancet*, March 6, 1909, p. 679).—Male, aged 45 years. Right inguinal hernia for years. Symptoms of strangulation 48 hours. Enlargement and tenderness of hernia with palpable abdominal mass in right lower quadrant. Volvulus of 8 feet of ileum with one loop in hernia sac. Death.

6. PRUTZ (*Archiv für klinische Chirurgie*, 1900, Bd. 60, p. 323; quoted from Clairmont, *Ibid.*, Bd. 88).—Male, aged 48 years. Pain 3 days. Hernia irreducible 2 days. Sac contained black loop. No constriction at neck of sac. Volvulus 200° to right of large part of small bowel. Resection. Death.

7. WECKSBURG (*Zeitschrift für Heilkunde*, 1902, Bd. 23, p. 39; quoted from Clairmont, *Archiv für klinische Chirurgie*, Bd. 88).—Female, aged 28 years. Right femoral hernia. Herniotomy. Persistent symptoms. Laparotomy. Volvulus of entire small bowel.

8-12. KNAGGS (five cases were reported in 1900).—Male, 1; female, 4. Average age, 50 years. Average duration of hernia, 15 years. Inguinal hernia, 1; femoral hernia, 3; umbilical hernia, 1. Bowel gangrenous in 2 cases. Death, 4 cases.

SUMMARY OF GROUP II.—Cases, 12. Male, 7; female, 5. Average age, 49 years. Average duration of hernia, 13 years. Type of hernia: inguinal 6; right 3, left 3; femoral 4; right 2, left 1, unknown 1; umbilical 1; not stated 1. Recovery, 4. Death, 8.

GROUP III.—*Volvulus of a distant oral loop above the hernia.*

1. MILLER.—The writer's Case II.

2. SICK (*Beiträge zur klinische Chirurgie*, Bd. 57, p. 336).—Female, aged 46 years. Left inguinal hernia 10 years. Enlargement of hernia 4 days. Symptoms of intestinal obstruction 3 days. Gangrenous loop in sac. Probable volvulus of intra-abdominal oral loop. Resection of gangrenous loop. Death.

3. SICK (*Ibid.*).—Female, aged 62 years. Subacute obstruction 4 days. Laparotomy. Gangrenous loop of small bowel strangulated in obturator hernia. Volvulus 200° in direction of hands of clock of most of bowel above hernia. Resection of gangrenous loop. Recovery.

4. BORSZEKY (*Beiträge zur klinische Chirurgie*, vol. liv, p. 350).—Male, aged 26 years. Double reducible inguinal hernia. Symptoms of intestinal obstruction 3 days. Laparotomy. Strangulated right obturator hernia. Volvulus of a greatly distended oral loop. Recovery.

5. KAYSER (*Deutsche Zeitschrift für Chirurgie*, Bd. 55, Heft 5 and 6; abstract from *Jahresbericht über die Fortschritte der Chirurgie*, 1900, p. 641).—Male, aged 49 years. Inguinal hernia. Sac contained incarcerated volvulus of cæcum and incarcerated loop of ileum. Intra-abdominal volvulus of ileum above the hernia. Death. (Note similarity to writer's Case II.)

SUMMARY OF GROUP III.—Cases, 5. Male, 3; female, 2. Average age, 51 years. Inguinal hernia, 3; average duration, 10 years. Obturator hernia, 2; average duration unknown. Recovery, 3. Death, 2.

GROUP IV.—*Volvulus of a distant aboral loop below the hernia.*

1. ROKITANSKY (reported in 1836; quoted from Clairmont, *Archiv für klinische Chirurgie*, Bd. 88).—Male, aged 54 years. Admitted moribund with large incarcerated left inguinal hernia. Autopsy: volvulus of cæcum and ascending colon. Proximal bowel greatly distended. Sac contained loop of ileum, which was slightly constricted by sac.

2. RICHET (quoted from Knaggs, *ANNALS OF SURGERY*, vol. xxxi, p. 427, 1900).—Male, aged 60 years. Right inguinal hernia 20 years. Symptoms of subacute intestinal obstruction 7 days. Reduced by taxis with difficulty. Symptoms persisted. Death. Autopsy: acute angle between cæcum and ascending colon. Proximal bowel greatly distended. It is remarked that the appearance of the cæcum suggested its former presence

in the hernia sac and Knaggs classes this case in Group V, viz.: volvulus immediately following reduction of a hernia. Considering its striking resemblance at autopsy to Rokitansky's case, however, the probable diagnosis seems to be volvulus of the cæcum with incarceration of a proximal distended loop in a right inguinal hernia.

3. DONA (*Revista de Chirurgie*, No. 4, p. 182, 1901, No. 10, p. 463; abstract from *Jahresbericht über die Fortschritte der Chirurgie*, 1902, p. 780, vol. vii).—Male, aged 48 years. Right inguinal hernia for years. Laparotomy for intestinal obstruction finding volvulus of sigmoid. Reduction. Death eighth day from pulmonary oedema. Autopsy: high loop of ileum passing beneath sigmoid to enter the hernia sac. Moderate stenosis caused by pressure of sigmoid. Loop in sac not strangulated.

SUMMARY OF GROUP IV.—Cases, 3. Male, 3. Average age, 54 years. Average duration of hernia probably over 15 years. Type of hernia: inguinal 3; right 2, left 1. Volvulus of portion of large bowel in each instance. Recovery, none. Death, 3.

GROUP V.—*Volvulus of herniated loop immediately after its reduction.*

Knaggs includes two cases under this heading. In one, autopsy after operation upon an infant 16 hours old for hernia into the umbilical cord showed volvulus of a portion of the small bowel. The second case has been tentatively classified under volvulus of aboral bowel (Richtel).

GROUP VI.—*Volvulus of the herniated loop long after its reduction.*

Knaggs includes here two cases in which individuals, both possessors of a hernia of long standing, were stricken suddenly with intestinal obstruction, the hernia altering in no way with the onset. Autopsy showed in one case a ruptured volvulus of the loop of small bowel supposedly the usual hernia occupant. Operation in the second case showed a volvulus of the small intestine, whose relation to the hernia, however, was doubtful.

Since 1900 no new cases for Groups V and VI were found in the literature; it seems impossible that they are as infrequent as this might indicate.

As to the mechanism concerned in these cases, we must base our ideas upon the generally accepted teaching concerning volvulus. Wilms, the acknowledged authority, believes that the loops of small bowel in normal motion frequently assume positions which twist their mesentery, and that these twists correct themselves spontaneously; that is, potential volvulus occurs frequently and is a perfectly normal state. However,

if for any reason, such as slight distention, intestinal stasis, etc., a twisted loop cannot readily empty itself, peristalsis increases, the twist becomes more pronounced and eventually cannot right itself; in other words, potential volvulus may pass into actual volvulus in the presence of even a slight hindrance to the intestinal current. Once established, a volvulus draws in more and more of the bowel, increasing at the expense of the distal loop, whose fixation at the ileocaecal valve finally limits the process. Every volvulus, of course, does not achieve these dimensions; we find torsion of the bowel in various stages and frequently influenced by such extraneous conditions as adhesions, etc. This conception of volvulus is quite analogous to that of intussusception, whose "normal" occurrence may be taken as a frequent cause of colic in early life, and whose "abnormal" occurrence as the exaggerated condition brought about in certain instances of the normal by some such conditions as those mentioned above, viz, distention or intestinal stasis. In a sense, clinically, intussusception represents the irreducible fixation of the bowel in a position naturally assumed and usually spontaneously reduced.

Certain conditions predispose a loop of bowel to volvulus, and perhaps the chief of these is lengthening of the mesentery. If the mesentery, for some reason, is drawn out so as to permanently increase the distance between the bowel and the root of the mesentery, and if the lengthening occurs only in a given sector, the bowel immediately above and below this point will be drawn into relatively close proximity, thereby throwing that loop dependent upon this lengthened mesentery into a U shape. It is quite evident that such a loop, being hung on a long suspensory ligament of narrow base, is much more liable to torsion than is a normal one. Furthermore, if this sector of the mesentery be the subject of repeated minor traumata the resultant inflammation brings about fibrous thickening and loss of pliability, thus hindering spontaneous reduction of a twist.

In almost every case cited above, there has been a hernia

present for years; the lengthening and thickening of the mesentery of a loop of bowel which has occupied a hernia sac for years is a matter of daily recognition in the operating room. Almost every case cited above is well past middle life; intestinal stasis is probably the rule in advanced years. These facts make it evident that individuals of advanced years with a hernia of long standing offer conditions very favorable for the occurrence of volvulus.

The mechanism peculiar to the individual groups is interesting:

Group I: The point of torsion lies within or just above the sac.

We may imagine that the loop, which has been repeatedly extruded into the sac, has assumed within the abdomen a certain degree of torsion which is momentarily more or less fixed; by a sudden exertion, associated perhaps with the increasing distention of a partial intestinal obstruction produced by the twist itself, this loop is extruded while in torsion. Descent into the hernia sac increases the tension on the mesentery, circulatory changes and distention of the loop follow, rendering spontaneous untwisting more difficult, while constriction at the neck of the sac, if present, adds further hindrance. If, now, the tumefaction and distention dependent upon torsion of the mesentery increase steadily and the constriction at the neck of the sac be relatively great, that constriction will sooner or later occlude both blood-vessels and gut, producing "strangulation."

It is to be noted, however, that hernial strangulation is not inevitable, and that operation frequently compels the diagnosis of incarcerated rather than strangulated hernia. As opposed to this view, it has been suggested that the twisted position may be assumed in the hernia sac, being caused by violent peristalsis; while this cannot be definitely disproven it seems highly unlikely.

Group II: One loop of an intra-abdominal volvulus becomes herniated.

Here the mechanism seems clear. The first event is intra-

abdominal torsion, to which the loop usually herniated is so prone. Increasing distention and straining ultimately force a loop of the volvulus into the hernia sac. Depending upon the comparative values of the factors named above, viz., swelling and distention of the gut and constrictive action of the neck of the sac, the extruded loop may show no difference from the retained loops, may become incarcerated, or may become actually strangulated, the intra-abdominal loops of the volvulus remaining quite viable (Knaggs, Group II, Case 2). The lesion in Groups I and II is almost always of the ileum.

Group III: Volvulus proximal to actual strangulated hernia.

In this instance, the first event is intestinal occlusion brought about by strangulated hernia; proximal to this point distention increases and peristalsis becomes more violent, ultimately resulting in volvulus. It is to be noted in these cases that volvulus does not concern a loop whose mesentery has been altered by repeated descents into the hernia sac but rather a normal loop, so that we may picture the process as a clear-cut example of the transformation from potential to actual volvulus, brought about by interference with the intestinal current. Two of the five reported cases were obturator herniæ. Considering the frequency of strangulated hernia, it seems remarkable that the condition is not met oftener; it is highly probable that the infrequency is one of observation rather than of occurrence. More frequent post-mortem examinations in cases terminating fatally in spite of apparently satisfactory operation will add to the number of this group.

Group IV: Volvulus below an incarcerated hernia.

These cases seem to be exceedingly rare, for there are but three to be found in the accessible literature. In all of them there was a volvulus of the large intestine, twice producing stenosis in the neighborhood of the hepatic flexure and once at the sigmoid. In Rokitansky's case operation was not made so that autopsy revealed the actual conditions, and here we find stenosis at the hepatic flexure, above which there existed extreme distention. One loop of ileum occupied the hernia

sac, less distended than the rest of the small bowel but not strangulated. We may reasonably argue that volvulus of the large intestine was the first event as well as the cause of death, and that extrusion of the bowel into the hernia sac was merely an incident due to distention and muscular straining. There must have been a variation from the normal fixation of the cæcum, allowing a wide excursion of motion, and this may have been produced or increased by frequent descents of the cæcum into the hernia sac; if such were the case, the hernia is to be regarded as a factor contributing toward the establishment of volvulus. In Richet's case it is probable that similar conditions existed, though an apparently successful reduction by taxis obscures the interpretation of the autopsy findings. Dona's case is more complicated. Operative reduction of a sigmoid volvulus was followed by death on the eighth day from pulmonary œdema. Autopsy disclosed a high loop of the ileum occupying a right inguinal hernia but somewhat constricted within the abdomen by the untwisted sigmoid. The picture would seem to be that of primary sigmoid volvulus complicated by an unusual though purely secondary phenomenon. The similarity between these cases and Hochenegg's picture of "combination ileus" immediately suggests itself.

Group V: Volvulus immediately after reduction of a hernia.

Group VI: Volvulus long after reduction of a hernia.

The explanation of these groups is that of volvulus in general, though influenced in certain cases by the predisposition to torsion of a loop commonly herniated.

Diagnosis.—The condition has rarely been recognized before operation. A diagnosis of acute intestinal obstruction due to strangulated hernia has almost invariably been made, only to be disproven during the course of the operation, at a second operation, or perhaps most frequently at autopsy. In the face of so grave a lesion accurate diagnosis is essential to successful management.

Advanced age is the rule. The average age of the collected cases is over 52 years; if the case of hernia into the

umbilical cord be excluded, the average age is over 54 years. The average age of Group I is over 62 years and of Group II is 52 years.

With few exceptions the hernia is of long standing. The average duration is well over 19 years, and for Group I alone is 27 years.

The location of the hernia appears to be of little help. Inguinal rupture predominates, occurring more frequently on the right than the left side, while umbilical and femoral rupture appear occasionally and usually in women. Obturator hernia occurs twice in the collected cases, in each instance strangulated and associated with volvulus of an oral loop.

The ruptures are almost uniformly described as of unusually large size.

Twenty-four of the cases are male, twelve female; a fact of possible significance.

The typical case is, then, a man past 50 years of age, frequently past 60 years, with a large inguinal hernia of long standing, often more than 20 years.

Several of the features of the acute case are important though far from pathognomonic.

Shock is usually extreme, pallor, sweating, and the facies of great suffering and anxiety having been noted repeatedly. This feature in the writer's cases was very striking indeed, and should have led to suspicion.

Abdominal pain may be severe and in certain cases may be localized and associated with more or less marked tenderness. In one case (Dobson, Group II, Case 5), a mass was palpated, leading to a correct diagnosis. Locally there is increase in size of the hernia, but pain and tenderness, while usually present, may be strikingly slight.

This great disproportion between the degree of shock and the signs in the hernia, accompanied by marked abdominal symptoms, is characteristic.

Up to the present time volvulus has been almost invariably an unexpected operative finding. The number of disasters due to unsuspected volvulus justifies emphasis of the self-evident

fact that any operation for strangulated enterocele must clearly demonstrate that strangulation, viz., a constriction at the neck of the sac, a compression ring on both afferent and efferent loops, absolute delimitation by these compression rings of the area strangulated, a dilated oral and a collapsed aboral bowel. Disregard of this elementary rule has probably led to many unjustified fatalities. In the cases under discussion, several atypical conditions may be found. The constriction at the neck of the sac may be slight or even absent, and the bowel show but moderately marked compression rings and slight circulatory changes. The constriction at the neck of the sac may be well marked and the ensnared bowel cyanotic or even gangrenous, but the proximal loop above the hernia presents the same appearance. It may be impossible to bring the aboral bowel out of the abdomen for examination. A taut band or mass may be felt just above the ring. Both aboral and oral bowel may be distended (above a volvulus). Both oral and aboral bowel may be collapsed (below a volvulus); this is rarely seen, but has been found by Sick in one case. Bloody fluid may escape from the peritoneal cavity. The presence of these atypical features makes it at once evident that the hernia cannot be the cause of intestinal obstruction. Upon the recognition of any one of them, abdominal exploration becomes immediately indicated. With careful observation few cases should be overlooked.

The greatest difficulty will be offered by volvulus of a distant oral loop above an actually strangulated hernia; here the rupture will dominate the picture, a mechanically satisfactory operation will be made, and probably no suspicion will be aroused. A collapsed oral bowel immediately above a strangulated hernia should be significant, but its presence is probably not constant. Volvulus is itself dependent upon distention, and in most cases will follow rather than precede; in other words, the oral bowel will be distended before volvulus is brought about. Fortunately such cases seem relatively infrequent and when overlooked at the time of operation they will be saved only by a second exploration if at all.

CONCLUSIONS.

1. Volvulus may produce in a hernia signs and symptoms which accurately simulate hernial strangulation; or it may be associated with actual strangulated hernia.

2. Volvulus, in either association, may readily escape recognition; it is probably contributing heavily to the mortality of strangulated hernia.

3. The diagnosis before operation is usually exceedingly difficult; there are, however, certain very suggestive features, viz., advanced age, the presence of a hernia for many years, shock out of proportion to the signs about the rupture, and marked abdominal pain and tenderness with occasionally a palpable mass.

4. The diagnosis at operation depends upon careful observation, there being certain signs which are pathognomonic; an operation undertaken for strangulated hernia must demonstrate absolutely the strangulation.

5. Volvulus proximal to actual strangulated hernia apparently offers no sure means of diagnosis other than routine abdominal exploration—a procedure which is manifestly not to be recommended.

THE RESTORATION OF FECAL CONTINENCE AFTER ILIAC COLOSTOMY.*

BY ANDREA MARRO, M.D.,

OF TURIN, ITALY,

First Assistant to the Surgical Clinic of the Ospedale San Giovanni;
Instructor in Operative Surgery.

To make an artificial anus is an operative intervention of such urgent necessity that the surgeon does not hesitate to propose it, and the patient, reduced to extremity, generally accepts it.

However, when the period of urgency is over, in both the patient and the operator a reaction takes place. The sick person, forgetting his past sufferings, begins to feel that he should prefer them to the miserable state to which he has now come, and the surgeon finds that the interesting case has developed into a troublesome one.

In such conditions, mind and sentiment work together to devise some relief for such misery; I add my attempt to the many already made.

Although the study is not yet illustrated by sufficient clinical matter (three cases only), I have already, with sufficient certainty, settled that the line of conduct I propose is devoid of dangers; it promises good success when it is employed in favorable cases, that is to say, those which can be radically cured.

Up to now I have, of course, limited myself to the so-called inoperable cases, which outlived the operation some months and remained cachectic and suffering, owing to the advanced condition of their initial disease and the pain, which were impossible to cure.

Hence, I could not ascertain whether the method would give the patient the desired help to enable him to attend to his

* Presented to the Royal Medical Academy of Turin, in July, 1909.

every-day business and social duties in such a satisfactory way as I have the conviction should be the case in radically operated cancers or in such grave conditions as to legitimize such intervention.

The fundamental idea of the method I apply consists in causing the proximal end of resection of the intestine opportunely mobilized to cross a subcutaneous tunnel, which is parallel to the exterior border of the rectus muscle, in such a way that a simple belt (that of the drawers, for instance), going round the trunk and passing over the iliac wings, should play the part of an effectual and comfortable band of compression on the intestinal segment running between skin and aponeurosis (see Fig. 3).

Such a compression may be rendered more active by a contraction of the abdominal wall, in the moments in which the individual feels the need of it, *e.g.*, in diarrhœic attacks and during active peristalsis of the colon. Theoretically its function would thus imitate well enough the natural function of the sphincters.

In the application, two other factors work together, which are not only favorable to the common purpose but also prevent the prolapse of the mucosa. These factors are:

I. The two angular deviations which the intestine undergoes, the one on account of its being carried into the subcutaneous tunnel, the other because it has to run through it.

II. The diminished vivacity of the peristaltic movements of the terminal segment, which is due to its adhesions with the abdominal wall.

I have already had the opportunity of determining the power of these two factors in the first case in which I ventured only to cause a short subcutaneous distance to be travelled over.

The direction of the line of travel may be from top to bottom or *vice versa*, according to the intestine it has to pass over and according to its relations with the wall and the length of the mesentery.

In my operations, I made it a rule to avoid any torsions and flexions superior to the right corner, as well as to prevent

the mesentery from stretching, preferring rather to cut it as far as it was necessary (see second case).

In order to conform myself to these rules, if then the subcutaneous segment must be a part of the sigmoid or of the ascending colon, it will generally be convenient to give it an ascending run (third case); if, on the contrary, it has to be the descending colon, it will be convenient to give it a descending run (second case).

In the first case, very good results could have been obtained by a complete ascending run, but as it was the first attempt, I did not risk a long subcutaneous run but studied rather to get a favorable position for the application of an effectual compressor.

These considerations over, I sum up the technic obtained from the study of the three clinical cases annexed to this work, bearing in mind the frequency of cancer of the rectal ampulla.

TECHNIC (MESIAL LAPAROTOMY).

If we admit the most ordinary case, that of the possible radically operable cancer of the rectum, in which the sigmoid and the mesosigmoid are intact, one can proceed as follows:

STEP I: Having gotten hold of the sigmoid and ascertained the upper limit of the tumor, apply at some distance from the latter a first occlusory* (compression clamp), going across the mesosigmoid from right to left with the blade, which has the

* These occlusories are clamps with grooved blades, one of which has an opening at the point and the other one a corresponding tooth. These clamps have an homogeneous and firm hold, which does not injure the serosa, reduce into sheets the muscular walls, nor cut the mucosa at the level of the two ribs of the groove.

The muscular walls which spread themselves into the groove constitute an effectual barrier, which also opposes itself to the escaping of the grasped organ should a resection be made very near the clamps.

The resection being made, the extremity of the intestine is imprisoned in the double groove, and one can only see between the blades that the line of resection of the serosa and the muscular is joined together, even after the removal of the clamps, hence the name of occlusory.

Similar occlusories which have a rack with three teeth, shut at the second one, are successfully used as simple compressors, over which latter they have some valuable advantages (see Bibliography¹).

opening, and shutting it in such a way that the adherent margin and the free one should fall not at the extremity, but in the middle of the compression so as to better control the hæmostasis (see Fig. 1).

When the mesosigmoid is much infiltrated, as happened in the second case, this application is a little more delicate, but it succeeds well owing to the propinquity of the point with the opening, which is able to follow the guidance of the touch, exactly in the same way as a channelled probe.

STEP 2: Mobilize a long section, about eight inches, of the sigmoid's upper portion and cut off a certain length of the mesosigmoid, as much as is necessary. Such a resection must be made at a certain distance from the adherent margin, in order to avoid the terminal vasal branches. Instead, in the above-mentioned second case the mobilization must be done by cutting off near the margin.

The last one or two inches must be brought out through the skin, to be temporarily used to establish a union with a rubber tube; and as they are to be eliminated little by little in a few days, it is not necessary to trouble about their means of nutrition.

STEP 3: An incision of about two inches along the outer margin of the left rectus muscle is made, the upper extremity of which does not go farther than the height of the horizontal line passing between the two upper anterior iliac spines (see Fig. 1).

This incision, which is parallel to that of the mesial laparotomy, involves, like this one, all the thickness of the wall, and it is rendered rapid and sure by taking hold, in the left hand, of the left margin of the laparotomy cut, in such a way as to take in all the breadth of the rectus muscle and to put the pulps of the four fingers in correspondence with the line of the cut of the peritoneum. As soon as the bistoury has entered the parietal peritoneum, the thumb, from the outside, and the ends of the other fingers, from the inside, occupy the hole thus created, and keep it gaping ready to let a second clamp be introduced. By opening this second clamp, a dilatation of the incision is obtained as large as is necessary by simple expansion with the fingers or obtuse instruments. Joining the skin to the border of the peritoneum with two stitches, one does away with the remote danger, that a little blood might get in the cavity, and afterwards avoids wasting time in searching for these borders which are to be joined to the intestine.

STEP 4: With the above-mentioned second clamp, the handles of which are at the exterior of the cut and the holding blades at the interior, the sigmoid is seized at about one-half centimetre above and parallel to the first clamp, going from left to right in the same opening which is already created in the mesosigmoid (see Fig. 1).

To prevent intestinal contents from remaining in the short segment of the intestine, it is taken away by pressing with the finger or with the second clamp itself; also a gauze is passed through the enlarged eye of the mesosigmoid, in order to protect the posterior wall of the sigmoid lying between the two occluding clamps.

STEP 5: The operator gives to the second clamp a torsion of 45° (see Fig. 1), to better expose the free margin of the gut included between the two occluding clamps; with a Paquelin cautery in the neighborhood of the second clamp, he penetrates the intestinal lumen and sterilizes with heat the mucosa and the very scanty intestinal contents, which may still remain after the above-mentioned pressure.

When the cauterization is finished, the resection is better completed with the bistoury, in order to proceed more quickly and to obviate the danger of burning the underlying gauze.

The resection is done near the second clamp; this whole act might be accomplished with the bistoury, with which an opening could be made in the same way as with the Paquelin, through which one would disinfect the intestinal cavity with a strong disinfectant.

For my patients, I used the Paquelin, which I think is safest, though I own that it requires a little more time and attention. These extreme precautions are justified by the ulterior treatment of the two intestinal extremities.

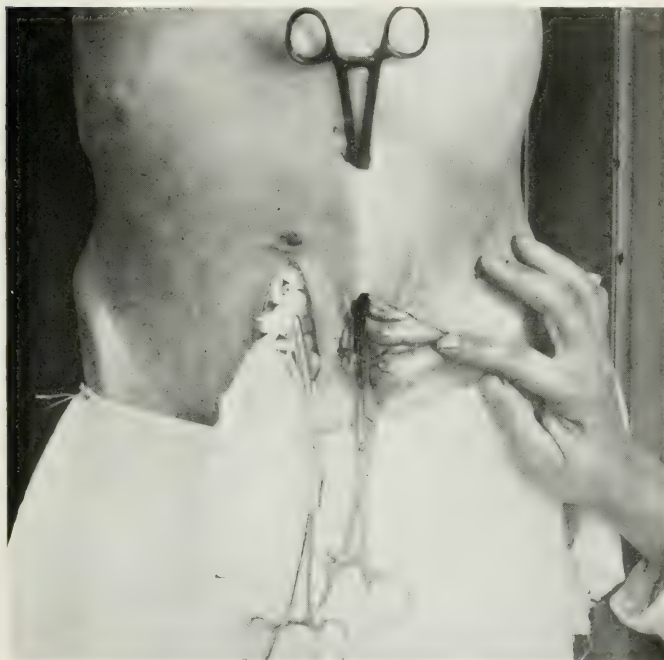
STEP 6: For the moment, the lower extremity is abandoned on the operative field, without being obliged to worry about protecting it with gauze if it has been cauterized; the upper extremity is at once extracted through the lateral incision by making traction with the second clamp by which it is held. The passing through is rendered easy by the fact that, the intestine being cut close to the clamp, the free, smooth surface of this latter may be pressed with force against one of the walls of the incision, thus rendering the way gaping and free.

FIG. 1.



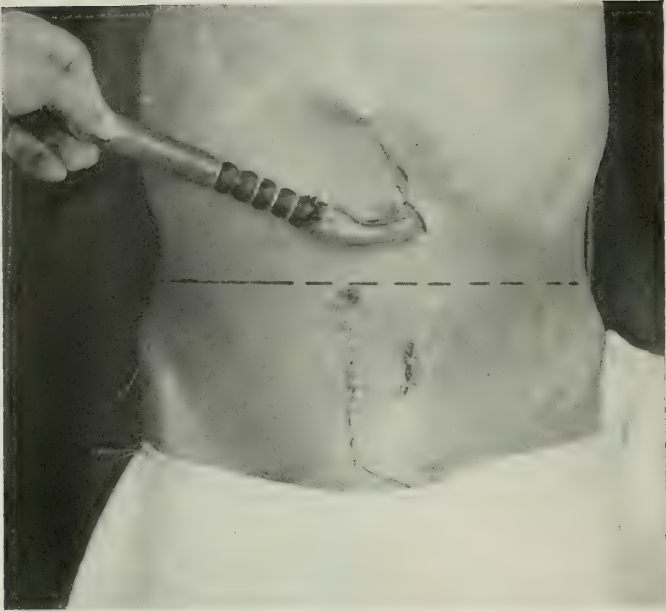
Showing mesial laparotomy, loop of sigmoid brought out, divided between two clamps; proximal end about to be drawn through opening through left rectus below level of the iliac crests.

FIG. 2.



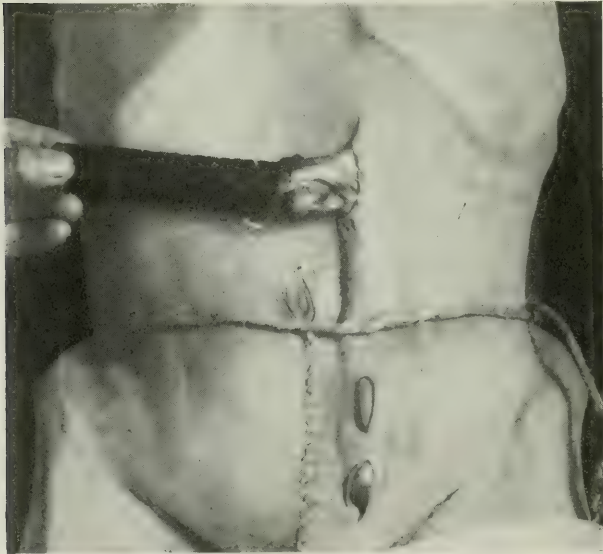
Proximal end of gut drawn through lateral incision, subcutaneous tunnel superficial to rectus muscle made, clamp inserted along tunnel ready to draw free segment of intestine into it and out at the upper opening of tunnel.

FIG. 3.



End of intestine projecting through upper lateral opening; rubber tube fastened into its lumen for fecal drainage; primary laparotomy wound closed. Transverse dotted line shows level of iliac crests.

FIG. 4.



Showing conditions produced in Case I.

Remove all the mobilized portion of the sigmoid through the lateral incision, taking care that the exit from the abdomen shall be produced without torsions of the intestine and without tension of the mesentery, which now occupies the lower angle of the incision itself.

STEP 7: Over the upper part of the abdominal rectus muscle, a second cut of two inches is made, which, differing from the first, is made only in the skin and in an obtuse manner. By pushing a third shut clamp through the subcutaneous connective-tissue plane, a subcutaneous tunnel is created along the exterior border of the rectus muscle, as far as the lower incision through which the sigmoid emerges.

By opening the clamp a little, the tunnel is dilated as much as is necessary to create a convenient way for the sigmoid. This dilatation should be made rather at the expense of the outer wall of the tunnel, in order to keep it well isolated from the laparotomy cut.

STEP 8: When the tunnel is established, the point of the second clamp by which the sigmoid is held is inserted in the lower extremity of the tunnel between the half-open point of the third clamp; with this latter the sigmoid is grasped in the neighborhood of the second clamp.

By exerting a light traction on the third and by pushing on the second clamp, it is easy to cause the sigmoid to run along the tunnel, and to make it come out from the upper skin incision with a length varying from $1\frac{1}{2}$ to 3 inches, according to the greater or the smaller mobilization of the segment of the intestine (see Fig. 2).

In order to obtain such a result, it is of course necessary to take the second clamp out from the tunnel; to effect this it is sufficient only to open it a little and draw it from the lower incision. As a rule, the extreme part of resection already grasped by the above said clamp remains closed. In any case, in order to protect against infection, it is expedient to cauterize the short extent of the mucosa, now protruding beyond the third clamp. This third clamp may be left in place for a time (about 24 hours) or, if it is desired to maintain the free passage of the anus, it may be substituted by a rubber tube (see Fig. 3).

I followed the first method in the first case, the second in the others, and I find this latter preferable, especially as asepsis of

the operative field is easily maintained, owing to the large sized rubber tubes, furnished with many circular external depressed grooves, which I have proposed and adopted in rectal operations (cancer and hemorrhoids^{1 2}).

These rubber tubes have some advantages over those of Paul. Only about a third of an inch of the intestinal tube is used for a fixation; the first fixation is kept valid for three days, and the successive ones for two days, in such a way that with exception of about two inches of sigmoid, coming out from the upper incision, one can maintain an aseptic condition for all the time necessary to the healing.

STEP 9: The skin corresponding to the first incision is sutured after having fixed the parietal peritoneum with some stitches to the intestine emerging from the abdomen. With more stitches, the skin of the second cut is fixed to the base of the intestinal part which protrudes from the tunnel. The lower extremity of intestine may be closed and dropped in or may also protrude at the lower angle of the laparotomy cut.

In order to save time, the second practice is better, but as a rule, according to my own experience, I advise the former.

To put the lower intestine in the abdomen, pass a suture through the whole thickness of the cauterized walls, jutting out from the clamp; then, two sustaining laces are applied below the clamp, one on the free margin, the other on the adherent one; in the latter is included also the line of resection of the mesentery in order to establish the necessary hæmostasis. Then the clamp is taken away, and a burying suture going from one to the other of the two sustaining points is applied.

The compressing grooves of the clamp help the burial of the line of resection.

The laparotomy gap is shut by layers. If there is any fear of the asepsis not being perfect it is better to use wire stitches in the shape of an 8. The use of these stitches renders also superfluous the definitive hæmostasis of the margins of the wounds. Such easily removable stitches involve the skin in the superficial loop, and in the deep serous membrane and the aponeurosis, or only the aponeurosis if, as I find preferable, the serous layer is sutured apart. In order to ward off the danger of impregnating the lines of suture, endeavor to isolate them from the general treatment by covering them over, for instance, with a bismuth and sublimate paste.

As will be seen from the clinical notes, the described routine may be deviated from, according to the various circumstances which might occur in an unforeseen condition. The essential deviations refer to the successions of the steps of the operation and to the number of the changes of the clamps. Such changes, being easy and quick, must not be spared if the conditions render them advisable.

Thus, for instance, in the second case, the diffused infiltration and contraction of the mesosigmoid would have rendered the intestinal mobilization much more difficult, if it had not been preceded by the resection of the intestine between two of the clamps.

In such cases, the section of the intestine is made midway between two clamps, put about a half inch one from the other.

Of course the mentioned case was an exceptional one, for which it would not have been appropriate to apply such an operation, which should be reserved to radically curable cases or at least when there are no conditions which absolutely exclude such presumption.

REPORTS OF CASES.

CASE I.—A. M., forty-three years old, gardener. A healthy, robust man. Rectal carcinoma; artificial anus, June 4, 1908. At about two inches from the anal opening, a tumor was felt projecting into the rectal ampulla, with smooth, irregular, globular surface and of a flabby consistency; it was impossible to reach the upper limit of the tumor, but one could see that it was fixed to the promontory. In the left iliac fossa was to be felt an ovoid mass, and in the groins small, hard glands.

Laparotomy below the umbilicus under lumbar anæsthesia.

The tumor, which occupied the last portion of the sigmoid, had a large base fixed behind. There were numerous infiltrated glands. It was judged inoperable. Between two clamps, a section was made at the upper limit of the sigmoid loop in such a way as to cause the distal cut end to protrude from the lower angle of the laparotomy wound. The upper extremity was treated according to the general technic already described, diverging only for the places of the two openings of emergence as can be seen in Fig. 4.

I succeeded in performing this aseptically, owing to the following method: When the third clamp was passed through the counteropening and through the subcutaneous tunnel, I grasped the intestine below the second clamp, which latter I took away, cauterizing the jutting stump and drawing out the third clamp. I then caused the intestine to run through the above-mentioned tunnel. I closed the first iliac cut with grapples and with a few serous cutaneous stitches I fixed the intestine at the second lower cut.

In this way, one gets a segment of intestine of about three inches, situated between skin and underlying aponeurotic muscular wall (Fig. 4).

Into the jutting part of the intestine was fixed a large rubber tube, which carried the fæces beyond the aseptic bandage. To better ensure its asepsis, the median laparotomy wound, at the lower corner of which the distal cut end of the intestine (kept closed by the clamp) was fixed, was first closed with some serous cutaneous stitches.

Post-operative Course.—For some days, apyretic. From the new canalized anus, gas and fæces exuded freely; from the old one, the expulsion of blood and mucus continued.

After three days, I fastened the intestine on the rubber at a distance of a half inch from the first ligature, which was to be cut.

The patient had no hiccoughs nor inclination to vomit. The whole of the operative field healed *per primam*. The stitches and the clamp were removed on the sixth day.

Afterwards, elevations of temperature appeared as well as frequent attempts, so intense as to prevent sleep, to emit secretions from the excluded intestinal portion.

It was not possible to wash the excluded intestine from the abdominal mouth towards the anus, and it was also impossible to pass an elastic probe through it.

As the excluded intestine protruded an inch from the level of the abdominal wall and was much inflamed, a resection was made, by applying a clamp at the point protruding, in such a way as to make possible washings of the anus with high pressure, without running the risk of infecting the fresh scars.

After this treatment I had the satisfaction of seeing the high temperature fall as if it depended on inflammation propagated to

the excluded intestine, which was the seat of the ulcerated tumor.

The painful calls of nature continued, which was the only disturbance the patient had. This disturbance, however, was so grave that I regretted not having taken away the diseased portion of the intestine, even if it had been impossible to take away also the adjacent infiltrated tissues. The patient declined in the hospital and at home. Before sending him home, I had an aluminum shell made (kidney shape), perforated with holes, of which the two concave extremities covered the two intestinal mouths and protected them from the clothes rubbing them; the convex mesial part of the shell was suited to exercise a pressure on the intestinal segment which passed under the skin, thus assisting the retention.

Ten weeks later the patient was found much wasted and pale. The artificial anus operated regularly.

The patient, who was a little constipated and remained in bed, had no need of the apparatus, answered the call of nature once a day, sometimes with the help of clysters.

From the two intestinal mouths, mucus was passing; but the neighboring skin was perfectly normal, especially that of the anus where the mucosa protruded about half an inch, not caused by prolapse but because a little segment was left jutting out (Fig. 4).

In the space of intestine which runs under the skin, hard balls were found.

The calls of nature continued, and were combated by an injection of morphia every other day. Of course their intensity was diminished because the canalization of the tumor section had improved, as the liquids now easily passed from bottom to top, so much so that by elevating the irrigator a little they gushed from the abdominal opening.

By introducing a finger into the abdominal opening, the tumor was felt at the depth of about two inches, so it was evident that it had spread towards the top; and by introducing a finger into the anus, the tumor also was felt at a depth of two inches, that is to say, a little lower. Patient died four weeks later.

The experience in this case dictated the general technic which precedes this case report.

Having seen the inconvenience of the abdominal fixation

of the lower intestine, and having recognized the advantages of it only theoretically, my advice is to renounce it, as I did in the second and third cases.

The aluminum shell is not necessary if the subcutaneous tunnel is made between the iliac wing and the costal arch, where the pressure of the clothes usually falls.

This is so much the more evident because the patients, who are kept a little constipated, do not need a permanent retention. I think the merit of this is due to the two angular deviations undergone by the intestine. Only in the diarrhœic state or with profuse flatulence the need of a mechanical help to the retention may be necessary, and then, the patient, stiffening the muscles against the belt of the clothes, might so obtain the effect of a sphincteric contraction.

CASE II.—A. T., fifty-eight years old.

Suffering from ulcerated cancer of the rectal ampulla, which had greatly invaded the superior part. There were present numerous metastases of the iliac and bilateral inguinal glands.

Operation, March 31, 1909, under spinal anæsthesia, good for 45 minutes. Median laparotomy. The abdominal cavity contained liquid slightly tinged with blood, the peritoneum was thickened, the bladder was forced higher by the rectal tumor. The mesosigmoid was nearly annulled by neoplastic coarctation and infiltration. Numerous mesenteric glands were swollen.

The sigmoid loop was cut between two clamps. About eight inches of intestine were isolated from the mesosigmoid and mesocolon, from necessity keeping close to the intestine itself. The lower extremity was closed with sutures involving the whole thickness of the intestinal wall standing out from the clamp. Afterwards the clamp was taken away and a seroserosa suture made without making a true introflexion, owing to the restlessness of the patient.

To avoid the danger of compromising the nutrition of the intestine and to avoid giving pain to the patient, I renounced making a later severance of the mesosigmoid, which would have been necessary to enable the colon to protrude at the level of the costal arch. Instead, I made a buttonhole at the external border of the left rectus muscle at the height of the umbilicus, from which

the intestine was made to protrude, pulling it through with the first clamp and grasping it at the outside with a second one. The colon appeared so deviated at right angles that, lest the mesocolon should undergo a harmful traction, the buttonhole was prolonged somewhat at the base, closing the upper angle with two stitches in the shape of an 8 after having fixed the peritoneum to the colon itself.

With a few stitches of silk the skin was brought against the colon protruding at the side.

Post-operative Course.—Most regular. In the first day a few fæces passed spontaneously from the colon. For two days hypodermoclysis was used. The pulse was regular: highest frequency 88. During the second day, the first contractions of the small intestine were slightly painful, which pains soon vanished, and in the following days regular expulsions with borborygmi occurred. At the end of the third day the patient was given magnesia lemonade. The tongue remained dry till the fifth day, showing how slight was the resistance of the cachectic and unfed patient. On the fourth day the hooks were taken off and the lace on the colon was changed, without succeeding, however, in squeezing it forcibly enough on the rubber, owing to the infiltration of the walls.

On the sixth day the constriction of the lace gave way and the dressing was soiled a little; it was changed and the two stitches of silk were removed. The two wounds were not at all red. The intestinal tube was changed by a caoutchouc involucre which did not hold perfectly. I therefore had an ordinary ice bag prepared, the neck of which was attached to a fixable band to go round the patient's body. By passing the intestine into the bag, it nearly stopped up the neck of it and when the patient was on his left side or in a standing position, the retention of the fæces was satisfactorily assured. Thus, I could allow the patient to get up on the seventh day; after half an hour he had to lie down on account of great weakness, although he had had an injection of camphor oil. During the night, the bag emptied itself on the bandage, soiling it completely.

Eleventh day: The protruding colon was clean; complying with the patient's will, I decided to leave it permanently.

Fifteenth day: General aspect improved. He walked alone, and could sit easily; the perineal pains had become regularly

less from the day of the operation, evidently because the irritating action of the *fæces* and the frequent contractions had ceased.

The emission of the *fæces* was sufficiently well regulated by the use of small doses of opium and bismuth; the patient must even at certain intervals use enemata to avoid obstruction.

REMARKS.—The operation much relieved the pains, and life was prolonged till August, that is to say, at least four months longer because the intervention was asked for when the patient was convinced he could not exist without it.

However, the inconvenience of being obliged to carry the bag, the necessity of a careful cleansing of the part to avoid inflammation, and also the use of the clysters presented to the patient, poor peasant, so many elements of discomfort that they greatly lessened the benefit of the above-mentioned advantages.

For these poor people this operation would be clearly indicated, if at the permanent continent anus, which I propose in this work of mine, it were still possible to join with it the radical removal of the rectum.

As seen from this very case, a grave operation can also be very well supported (when one scrupulously applies the rules of a good technic, which saves one from accidental complications) even in a cancerous cachectic, weakened by a prolonged lack of nutrition. If, then, it is a question of operating on individuals who are still radically operable, it is not the duration of half an hour more or less which will influence in the choice of our intervention. When the patients and relations are advised of the gravity of the operation, it is better to face the greater danger of an immediate failure than to expose oneself to painful complaints after a short interval.

A scientific result worthy of consideration, furnished by this case, is the control on the strength of the parietal circulation in the sigmoid and inferior portion of the descending colon.

Notwithstanding the excision of the mesentery, a segment of more than six inches was kept perfectly nourished. In a continent anus, typically made, one can deduce that the passing through tissues normally vascularized would favor the nutrition

of the mobilized segment, but in this particular case this factor was missing for the two-thirds which protruded uncovered from the abdominal wall.

In spite of this, the idea of re-covering the stump with Thiersch's skin grafts had been entertained, as the condition was so encouraging and the beginning of a regular extension of epithelium from the cutaneous margins was evident.

CASE III.—F. T., forty-six years old.

Woman of robust constitution, but now cachectic. Tumor of the rectum distant about three inches from the anus, its lower limit embracing all the perimeter of the rectum, obliterating nearly all the lumen; tumor fixed to promontory.

Operation, May 15, 1909, ether narcosis. Median skin incision displaced laterally along the external margin of the left rectus muscle so as to avoid a special lateral incision of the wall for the emergence of the sigmoid.

A tumor the size of an orange occupied the terminal portion of the sigmoid and the beginning of the rectum, and was firmly fixed to the sacrum. In this case it was necessary to treat the upper extremity as in the first case, that is, carrying the resection of the mesosigmoid beyond the vascular arcades near to the adherent margin, since in this case the infiltration and shortening of the mesosigmoid, found in the second case, was not present.

Thus the mobilization of a space of about six inches in length was obtained. The lower extremity, on the contrary, sank down in the same way as had been done in the second case, with satisfactory results.

The only deviation from the technic necessary was due to the fact that the laparotomy, having been made sidewise to the rectus, it was necessary to bring out the sigmoid so that it remained at the lower angle of the cut, three-quarters closed by disconnected stitches. Thus, the advantages of the independent buttonhole already described were lost, and, in fact, the post-operative course during the first days was much less brilliant because there was a little obstruction owing to the squeezing provoked by the suture, which rendered the upper side of the incision narrow and rigid. The stagnation of the excrements provoked their condensation; thus, they could not freely emerge until the rubber tube (on which

the sigmoid's extremity was tied to better protect the cutaneous lateral incision from which it protruded) was taken away.

This disturbance was, however, quite transitory and afterwards the anus operated very well.

The belt of the clothes could produce such efficient compression on the segment of intestine which ran subcutaneously that there was every reason to expect that the continency could have been permanently secured. Unfortunately it was not possible to continue the observation, as the general serious condition of the patient caused her sudden departure from the clinic. She died eight months later.

REMARKS.—The point of emergence of the sigmoid through the abdominal incision was undesirable. More time was lost in dissecting the cutaneous border than in creating a separate buttonhole; the vitality of the tissues was more compromised; along the segment of intestine numerous laces and stitches of suture were placed, and, what is more serious, there was the risk of closing the laparotomy incision too little or too much. In the first case there would be subsequent hernia; in the second compression of the intestinal segment, which can only provoke a certain obstruction, as was the case in this patient. In fact, if it is easy and sure to regulate the amplitude of a separate incision, it is difficult to calculate how much a suture constricts an opening, as the constriction depends not only on the distance of the stitches, limiting the desired buttonhole, but also on the thickness and the width of the margins taken by the stitches and on the manner of closing the same.

Another lesson may be derived from this case: it is the necessity of removing the rubber tube from the extremity of the artificial anus when the excrements are formed, as the narrowness and rigidity of the tube tend to obstruct their exit.

Summarizing the experiences derived from the three mentioned cases: Following the explained technic, the operation is easy, quick, and safe. Each patient bore it in the best manner, and the local cure was most perfect.

The two bends of the intestine successfully assist to cause

the retention; and the adhesions formed with the abdominal walls, besides diminishing the peristalsis, must also directly contribute to fix the mucosa. The fact is that after four months in the first case the flabbiness of the mucosa was altogether missing, the neighboring skin being normal.

Whether the compression on the segment of intestine, placed between skin and aponeurosis, would be adequate to answer the requirements of the social life of the individual could not very well be determined in these three poor unfortunate persons, who, exhausted by their malignant disease, could not work again. They, for the greater part of the time, kept to their beds; and since they had a sufficient retention to make their condition tolerable, they avoided the discomfort of having the abdomen pressed by a band.

The second case represents a new and interesting contribution to the ideas which have already been gathered in clinical and experimental studies on the vitality of the intestinal tube after it has been more or less extensively deprived of the mesenteric insertion.

In the typical application of this method of mine, the intestine is literally involved in the subcutaneous cellular tissue, and naturally this last condition is favorable to the vitality of the loop, sufficiently so to save the operator any fear of the dangers inherent to the abandonment of the loop in the peritoneal cavity.

It is better to bring out the intestine through a particular buttonhole. Thus time is gained, although this does not seem to be the case; the segment is put between little injured tissues, the laparotomy cut can be well closed with stitches which remain isolated from the space occupied by the subcutaneous segment, avoiding with the greatest probability their operative or post-operative soiling.

If the patient is well purged beforehand and has no serious obstructive disturbances, in order to better guarantee the asepsis the clamp used to make the tunnel can be left on for 24 or 48 hours. I have been able in other resections of the rectum to allow it to remain three days without notice-

able inconvenience; but, on the contrary, in these three cases, in which it was necessary to have the alvus free as soon as possible, the asepsis was protected by tying the extremity of the segment on a rubber tube, reinforced by a tube of glass or metal, thus being able to improvise an excellent conductor of the excrements out of the antiseptic bandage.

It is, however, necessary to keep in mind the possible obstruction which may arise from the blocking of the rubber tube by formed fæces, which exceptionally happened in the third case. The lace which fixes the intestine to the tube cut the intestine after three days, and it was necessary to replace it with another at about one inch distance, hence the necessity of keeping the intestine protruding about two inches from the cutaneous buttonhole.

With regard to the treatment of the lower bowel end, I think its sinking preferable, owing to some observations made, which I shall sum up briefly: In the first case, with the idea of being able afterwards to alleviate the pain and favorably modify the ulceration with simple or medicinal washings, I had fixed such extremity to the lower angle of the laparotomy wound, using for this purpose the same clamp applied for the resection, and which, simply placed on the external dressing, ensured its fixation and retention for a period sufficient to the healing. The post-operative condition was excellent and regular till the sixth day. However, when the clamp came away, a high temperature appeared, as well as frequent desires to emit the secretions of the excluded intestine, and these were so strong as to prevent the patient from sleeping. It was not possible to get a lavage from top to bottom, and as I did not want to do it from bottom to top, for fear of soiling the recent scar, I decided to close this mouth and to perform boric washings through the anus. The fever fell, but the patient went on declining rapidly as if the tumor were excited to rapid increase in size.

I had the impression that the fixation of the stump in the abdominal wound had an influence on these facts, and the observation that they were missing in the two other cases in

which the lower extremity was sunk would indirectly confirm it.

In these cases, in order to guarantee the asepsis in which a fecal soiling of the dressing can at any moment arise, as in fact happened on the fifth day of the second case, I always protected the suture lines with bismuth and sublimate paste and to this I attribute the merit of the full success.

BIBLIOGRAPHY.

- Marro: Automatische und graduelle Festklemmung der Spitzen bei hämostatischen Fängen Histotritoren, Darmkompressoren und Okklusoren, *Deutschen Zeitschrift. für Chir.*, 1910, iv, Jun.
- Marro: L'Esportazione radicale delle emorroidi, *Tipografia Subalpina*, Marino, 1910.
- Lauz: Experimenteller Ersatz des Mesenterium, *Zentralbl. für Chir.*, June 1, 1907.
- Scudder: *Boston Med. and Surg. Jour.*, 1908, cliv, 338.
- Frank E. Bunts: The Separation of the Colon from its Mesentery, A Clinical and Experimental Study, *ANNALS OF SURGERY*, June, 1909.
- Marro: Communication to the Royal Medical Association of Turin, March 20, 1903; Un nuovo metodo di entero anastomosi. Nel volume scritti medici pubblicato in onore di Camillo Bozzolo, *Unione Tipografico*, editrice Torino, 1904.
- Roux: *Semaine Medical*, 1907.

external auditory meatus (Fig. 1). This wound was sutured; it healed by primary union, and did not figure in the further history of the case. All the other organs were normal; the pulse was irregular in rhythm but not in force.

On September 27 the patient complained of a dull headache in the frontal region, and showed some signs of cerebral pressure. Temperature, 99.5; his pulse ranged between 66 and 90; respirations, 22. On the following day he was nauseated at times, and complained of pain in the region of the wound. The symptoms of intracranial pressure became more marked. The temperature

FIG. 3.

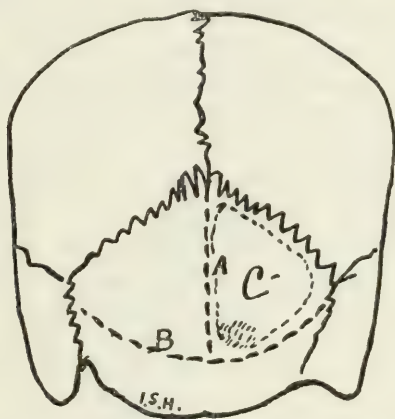


Diagram to indicate the position of the interoccipital (A) and transverse occipital (B) fissures, and loose piece of bone (C) found almost entirely detached at operation. Shaded area indicates only point at which pericranium was adherent. Dotted line, approximately size of piece with reference to skull.

ranged from 99 to 100; pulse, 60; respirations, 20. On the following morning his pulse was 54; temperature, 99; respirations, 24. The small scalp wound had firmly healed, and there was nothing abnormal about it. Over a corresponding area on the opposite side of the head the following conditions were noted: A section of the scalp about three inches in diameter was raised as if by a hæmatoma, and the region felt œdematous. In the centre of this area was a loose piece of bone, so free that it could be tipped up or rocked under the fingers in all directions. This œdematous area pulsated and bulged prominently. No crepitus was elicited upon moving the bone fragment. There was no apparent connection between this loose bone and the surrounding œdema and the recent injury. Dr. Haynes said that as he did not

at the time have the full history of the patient, he could not explain the condition and did not attempt to do so.

Operation: A vertical incision two inches long over the inner edge of the movable segment of bone gave exit to the usual scalp bleeding, and also to a gush of a very watery fluid, which, as the bleeding was controlled, became clear, but with a faint yellowish tint. The fluid flowed more forcibly at each pulsation of the heart. It was estimated that about six ounces of fluid escaped, but its loss was not attended by any perceptible changes in the heart's action or of the respiratory rhythm.

From the middle of the first incision, a second cut, two inches long towards the right, disclosed a portion of bone free from

FIG. 4.

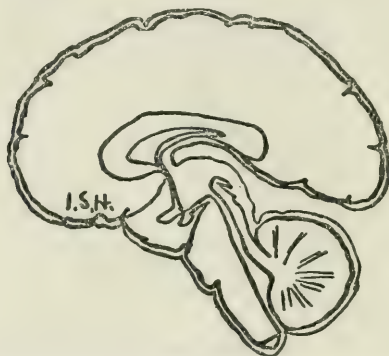


Diagram showing the formation of the velum (Gray, p. 947). This also shows the potential subdural space.

any pericranial attachment excepting for an area of about a quarter of an inch at its lower inner margin. When this was severed, the bone was picked up and removed, there being no dura beneath it attached to it or visible. The removal of this section of bone revealed a large cavity whose greatest dimensions were about an inch from the surface, where the space showed a triangular shape, with sides about two inches in width and with the corners rounded off. The cavity thus triangular on cross section was pyramidal in the opposite direction, with base at the surface and the apex narrowing forward to an orifice about three-fourths of an inch in diameter at a depth of two and a half inches from the surface. The cavity of the cyst did not end here, but its direction changed to a more upward course. With the probe, this extension was about an inch in its vertical measure-

ment and half that distance transversely. The probe was stopped four and a half or five inches from the surface.

A careful study of the cavity showed that the dura did not come within a quarter of an inch of the margin of the bone at any point. The margin of the bone in the skull as well as in the loose piece removed was bevelled off to a thin edge. This edge in the skull was cut back with the rongeur close to the reflection of the dura, and the present size of the defect in the skull is just within the line of dural reflection. The opening which still existed in the skull is circular, with a diameter of an inch and a quarter, and corresponds to the right half of the upper portion of the occipital bone.

Examination of the cyst walls at the time of the operation showed, so far as could be determined, that the inner or right wall of the cyst was formed by the falx cerebri, which had been crowded half an inch or more towards the right of the middle plane, and was concave towards the cyst, evidently from pressure of the fluid. The lower half was apparently formed by the depressed tentorium cerebelli, and the outer and upper wall by the flattened occipital pole. All of these structures were covered by a whitish layer of tissue which was much thicker in the angles of the pyramidal cavity than elsewhere. This layer did not look like organized connective tissue, but more like the plastic lymph found in abdominal operations. It was, however, firm and intimately connected to the deeper structures. It covered all the parts to such an extent that Dr. Haynes said he could not be absolutely sure of the structures beneath it, which formed the walls of the cyst, excepting over the flattened brain, where the gyri shimmered through.

As to the origin of the cyst, it was undoubtedly traumatic. There probably was a fracture of the occipital bone such as to sever the right half of the upper portion from the rest of the bone. Undoubtedly there was a hemorrhage beneath the pericranium and also one external to and probably internal to the dura. That these two areas connected with each other through the fractured bone.

As time went on and the cyst became more definitely formed and increased in size, the segment of bone was finally separated along the fracture line from the occipital bone and along the suture line from the parietal so that eventually the fragment

was as found at the time of the operation without any connection with the rest of the skull. Of course the fragment might have been a large occipital Wormian bone. No proof one way or the other can be given at this time. In either case the formation of the cyst would be the same. While the formation of the cyst is easily explained as the result of an intracranial hemorrhage, it is not so easy to account for the fact that there was no dura beneath the loose bone, but that the outer wall of the cyst was formed by the pericranium. Further the dural reflection from the bone, as stated before, was about a fourth of an inch from the bony margin of the skull defect. The further development of the cyst was undoubtedly into the great longitudinal fissure at the left of the falx cerebri and above the tentorium in the manner as explained by the diagrams. Why this cyst should apparently be developed to the left of the mid-plane and the opening through the skull be to the right Dr. Haynes had no explanation to offer.

Dr. Haynes said he did not attempt to remove the cyst wall, which he thought would have been physically impossible, as the cyst extended forward out of sight. Neither did he attempt to see if the membrane would strip up with ease or not; he left it alone, and thought that by so doing the boy was still alive and apparently normal in all respects. The wound was closed without drainage in the hope that any excess of fluid would be taken up by the subcutaneous tissue.

During the night following the operation the patient was restless and complained of pain in his head. His temperature at one A.M. was 102.5; pulse, 78. His general condition was good. He was rational, and answered all questions. His pupils did not react to light, and his left pupil was more dilated than the right. There were no paralytic symptoms. The patient vomited once.

On October 4, five days after the operation, the patient complained of a severe frontal headache and of pain in the right leg. On this day he vomited a large amount of clear fluid. The wound at this time bulged considerably, with pulsations synchronous with the heart. Kernig's sign was present; the knee jerks on both sides were absent; no ankle clonus; no Babinski. There was slight stiffness in the muscles of the neck. A small opening was made in the lower portion of the wound, and the excess of fluid allowed to drain off. This relieved the pressure symptoms, and the boy became quiet and went to sleep. On the

following day he was comfortable, and a lumbar puncture resulted in a dry tap. On October 8 his temperature and pulse were normal; the boy was comfortable but drowsy, sleeping most of the time. The stiffness of the neck had almost disappeared; also Kernig's sign. Sluggish knee jerks could be elicited. On October 10 another lumbar puncture was done with the result of getting only a little gelatinous fluid.

On October 11 the patient complained of a severe headache, and his temperature, which was 99.5 in the morning, rose to 103

FIG. 5.

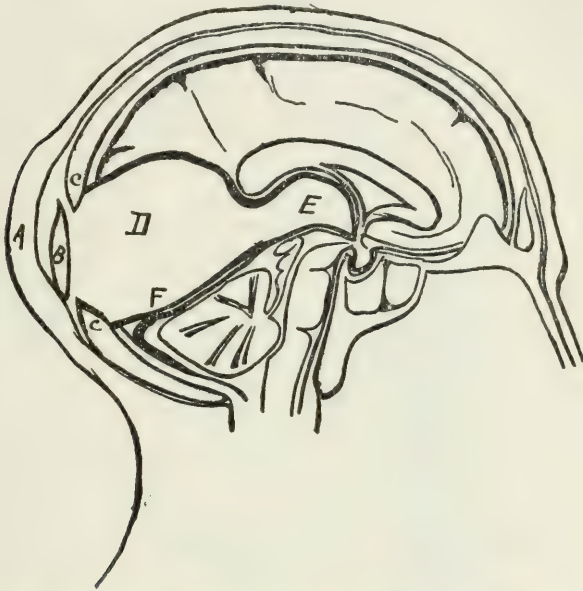


Diagram to show situation, development, and relations of cyst. *A*, bulging scalp; *B*, loose cover of bone attached only to pericranium over small area at lower inner angle; *C, C*, margins of bone, thin and devoid of both pericranium and dura; *D, E*, cyst cavity—*E*, anterior extension beneath callosum; *F*, depressed tentorium cerebelli.

in the evening. The scalp over the cranial opening was bulging. The wound was again opened at its lower end, and a considerable quantity of fluid escaped, with gradual disappearance of the compression symptoms. By the evening of October 14 there had been a gradual improvement in the boy's condition. His temperature was normal; pulse, 64. During the night he again became restless and the same train of symptoms indicating pressure appeared. An examination of the wound showed that

it was again bulging. Inasmuch as the symptoms were not urgent, Dr. Haynes decided to wait and see if the boy himself could not take care of the excess of fluid. His temperature that evening rose to 103.3. Cold sponging and enemas were resorted to with good effect, and the patient slept quietly during the greater part of the night. He gradually improved under the let-alone policy, and by October 21 his temperature fell to normal and had been so ever since. The wound remained depressed when he was in the upright position, but after lying down for a time it was flush with the rest of the scalp (Fig. 2). The boy's condition now seemed to be normal, and he made no complaint provided he could get a nap in the afternoon; otherwise, he complained of a headache.

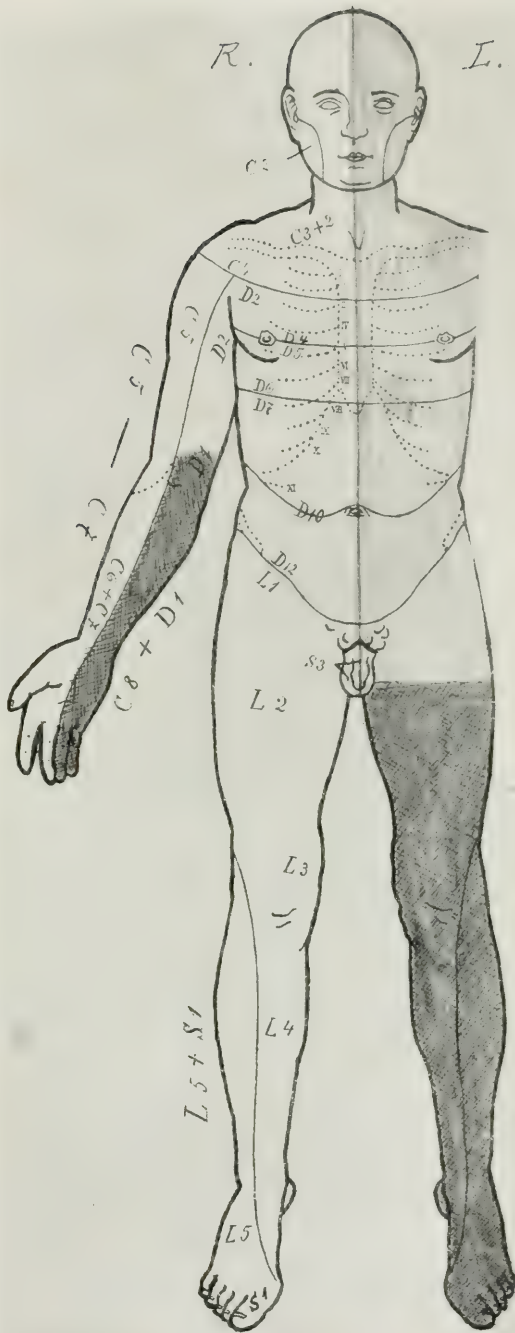
This case, Dr. Haynes said, was unique in the following particulars: (1) The existence for ten years of a very large cyst, causing great compression of the left occipital portion of the brain, with very few and slight symptoms. (2) That the external wall of this brain cyst was the pericranium. (3) That a slight traumatism sufficed to start up an active secretion of fluid in the cyst and cause the symptoms. (4) That after external relief on two occasions, the boy's system had apparently adjusted itself to taking care of the excess of fluid, so that for over two weeks he had had no further symptoms of compression.

DR. WILLIAM M. LESZYNSKY, who had examined the patient shown by Dr. Haynes, said that from a neurological stand-point the boy was absolutely normal with the exception of a right lateral hemianopsia of the homonymous type, which indicated that the lesion was limited to the cuneus in the left occipital lobe.

NEUROFIBROMA OF THE BRACHIAL PLEXUS: RESECTION.

DR. HAYNES presented a man, 22 years old, who was admitted to the Harlem Hospital on October 16, 1910, with the history that two years ago he fell a distance of eighty feet, landing on his left arm. He was unconscious for three days following the fall, but his physician told him that his only injury was a broken elbow. He had no scalp wounds nor symptoms of intracranial injury. For the first few weeks after the injury his elbow improved and was apparently healing, but it seemed to be distorted, and within six months the injured elbow began to be swollen and painful. It was found to contain pus, and was opened and drained. Fol-

FIG. 6.



Showing area of anæsthesia on right upper extremity, and of hemianæsthesia upon the side on which the arm had been amputated.

lowing this he had two operations for the removal of dead bone, and subsequently the arm was amputated above the elbow. The stump became infected, but healed within a few weeks.

One year after his injury the muscles of the stump began to contract, and finally there was a continuous clonic spasm of the muscles. Because of this, the arm was re-amputated one year ago at the shoulder. Following this second amputation, he was free from any muscular contraction for the next six months, when a contraction of the muscles about the shoulder was noticed. This rapidly increased in severity until there were continuous clonic spasms of these muscles, accompanied by severe pain. About six months ago he was operated on for the relief of this condition, and he was told that certain nerves in the neck were cut. This operation gave him relief for only a few weeks, when the spasm and pain returned the same as before.

Because of the continuous pain and twitching, his general health became affected: he was unable to sleep at night; he lost his appetite, grew thin, and was at times hysterical.

On September 10, 1910, he was first admitted to the Harlem Hospital, where he sought relief because of his general rather than the local condition. His symptoms then were suggestive of typhoid fever, but his temperature, which was at first 102, soon dropped to normal, and he left the hospital on October 16. He returned the same evening, saying that he was too weak and miserable to go about his work. His symptoms were about the same as at the time of his previous admission, *i.e.*, weakness, lassitude, slight fever, occasional nausea and vomiting, and severe headache. There were no positive indications of typhoid, and a physical examination failed to show any abnormalities other than a constant clonic spasm of the muscles about the shoulder, the serratus magnus showing the most severe spasm. Under general treatment, diet, catharsis and antipyretics, his temperature soon reached normal.

Operation, October 22, 1910, by Dr. Haynes: An incision was made on the outer aspect of the neck across the middle of the clavicle, which was sawn through, down to the end of the stump. The brachial plexus was readily found, and if it had already been once severed it had evidently united and showed no evidences that any of its cords had been divided. The nerves were exposed up to their exit from the spine. Involving all but the one or two

upper nerves was a large, dense, hard mass which cut a good deal like ordinary gristle. The entire brachial plexus was severed as deeply toward the spine as possible, and then the distal portions of the nerves, with the included atrophied subclavian vessels, were removed to their distal attachment or distribution. Hemorrhage was arrested, the fragments of the clavicle were approximated by a kangaroo suture through the subclavian muscle, the space drained through a stab-wound at the posterior axillary line, and the wound closed.

Recovery from local pain and spasm of the shoulder muscles was immediate. The wound healed by primary union, and the patient said he felt in better condition than he had since the original injury.

DR. LESZYNSKY said that in this case nothing was to be found bearing upon the neurofibroma excepting an area of anæsthesia on the right upper extremity which corresponded with the eighth cervical and first dorsal segments. In all probability there was a neurofibroma involving the posterior roots entering these spinal segments.

An interesting feature of the case was that the man had a hemianæsthesia upon the side on which the arm had been amputated; this dated back to the time of his fall, two years ago, and was apparently a manifestation of traumatic hysteria. It was accompanied by concentric contraction of both fields for white and form. The speaker emphasized the importance of a careful study of the cutaneous sensibility in cases of this character; unless this was done, the condition might readily escape recognition.

DR. HENRY H. M. LYLE mentioned a case of injury to the brachial plexus in a man who was struck by a fly-wheel, necessitating a resection of the plexus and amputation of the arm. This was followed in the course of time by severe spasm in the stump.

Characteristic oculopupillary signs were present on the affected side showing an intravertebral lesion of the posterior roots.

FOUR CASES OF RENAL CALCULUS.

DR. ALEXANDER B. JOHNSON presented an Italian cabinet maker, 31 years old, married, who was admitted to the New York Hospital on July 26, 1910, complaining of pain in the left lumbar region. The patient gave a history of having had three attacks of gonorrhœa, the last seven years ago.

His present trouble began some four or five years ago, with occasional attacks of colicky pain in the left flank. There was no radiation of the pain at this time. The attacks at first came on every two or three weeks. He noticed that during these periods his urine contained a fine, sandy material, together with some pus. Urotropin had been prescribed by his physician, and seemed to give some relief during the attacks. The attacks gradually became more frequent and severe, and at rare intervals there had been similar pain in the right flank. Seven months ago he had an extremely severe attack in which the pain was localized in the left flank. The patient was doubled up with pain for some hours. After the passage of a small stone per urethram the pain subsided. For the past two months there had been a constant cutting pain in the rectum and left testis, and twice within this period the patient had noticed blood in his urine. He further stated that for a period of a year and a half he had visited a hospital in this city about once a month, where the pelvis of his left kidney was washed out.

The patient was fairly well nourished and developed, and in good general condition. The abdomen was soft; there were no tenderness nor masses. No pain on deep palpation over the kidney areas. The X-ray showed a shadow in each kidney. The patient's output of urine averaged 45 ounces in twenty-four hours. It contained a very faint trace of albumin, many triple phosphates and a few pus cells.

Operation, August 1, 1910: The kidney was delivered through a transverse elliptical incision, and the stone was located with a hat-pin probe. The kidney was then split longitudinally, and the stone delivered with forceps. It was fish-tailed in shape, with a serrated border, calcareous in consistence and whitish in color. After the operation, the patient ran a rather high temperature for a week, when it gradually subsided. On the night of the fourteenth day after operation, the patient voided about twenty ounces of bright red fluid, and the next day his temperature rose to 104. It fell to normal within 24 hours, and his further convalescence was uneventful. The wound healed *per primam*, and the patient left the hospital on the twenty-first day. At that time his urine contained a small amount of pus; no blood. The daily quantity of urine had increased, and frequency was about as before. He was entirely free from pain.

This patient was re-admitted to the hospital on September 28, 1910, complaining of pain in the right flank, radiating downward along the course of the inguinal canal toward the right testis. The history he gave was that five days prior to his admission he was awakened by a cutting pain in the right flank. The pain was extremely severe, causing him to perspire freely, and to vomit once or twice. It gradually became less severe, becoming dull in character and radiating downward into the right testis. He had occasional chilly sensations followed by fever. No blood had been noticed in the urine. Upon examination, no tenderness nor mass could be made out in the right flank. The X-ray showed a shadow in the right kidney.

During the five days that the patient was under observation in the hospital prior to operation, his urinary output averaged 60 ounces in 24 hours. It was alkaline, with a specific gravity of 1020, clear, amber, containing a faint trace of albumin, many leucocytes and epithelial cells and triple phosphates. No blood nor tubercle bacilli. From four to eight ounces were voided at intervals of from two to five hours during the day.

At the operation, which was done on October 3, 1910, the technic followed was similar to that employed on the opposite kidney. The kidney was exposed and opened, and a fish-tailed stone, slightly smaller than that found in the left kidney, was removed. The patient's convalescence was practically uneventful, and since the second operation there had been no recurrence of the pain in either flank.

Dr. Johnson's second case of renal calculus was that of a man, 20 years old, single, a clerk, who was admitted to the New York Hospital on July 24, 1910, complaining of a sharp, shooting pain in the right flank. His family history was negative, as well as his past history, with the exception of an operation for the removal of the appendix two years ago. That operation had failed to relieve the pains of which he complained. He had a urethritis seven weeks ago.

The patient's present trouble began about four years ago with a sharp, shooting pain in the right flank, often beginning at a point about two inches below the costal margin in the midclavicular line, and radiating backward along the costal margin to the spine. There was no radiation downwards. These attacks came on at night at intervals of two or three weeks, and lasted from a

few seconds to half an hour. The pain had never been severe, and there was no history of vomiting nor sweating. The patient had not noticed any increase in frequency of micturition, nor had any blood been noted in the urine.

Upon examination, the patient's general condition was found to be excellent. The abdomen was soft, and there was moderate pain on deep pressure over a point two inches below the costal margin in the midclavicular line, and at a point posteriorly two inches to the right of the spine, just below the level of the twelfth rib. There was no palpable mass. An X-ray picture showed a shadow in the right kidney.

On admission, the patient's temperature was 98.6; pulse, 88; respirations, 26. His average output of urine was 36 ounces in twenty-four hours. It had a specific gravity of 1020 and contained a faint trace of albumin and many leucocytes and epithelial cells. No blood nor tubercle bacilli.

Operation, July 30, 1910: The kidney was exposed and opened as in the previous case, and a flattened, mahogany-colored stone, about half an inch long, together with three smaller ones about the size of grape seeds, were removed. The smaller calculi were sharp-pointed.

Aside from a slight rise of temperature after operation, and considerable abdominal distention for some days, the convalescence was uneventful. The wound healed *per primam* excepting at the point of packing. The amount and frequency of urination remained as before operation. The patient was discharged on the sixteenth day, free from pain.

Dr. Johnson's third case of renal calculus was in a school-girl, 13 years old, who was admitted to the New York Hospital on August 17, 1910, complaining of pain in the left flank. Her family history was negative. The patient stated that she had kidney trouble about two years ago, but could not give any details regarding her attack save that she was much distended. Her present trouble dated back to her second year, when she began to have attacks of sharp, cutting pain in the left flank. These occurred at intervals of two or three months. The pain did not radiate, but had always been localized in the left flank. Recently these attacks of pain had been more frequent and severe, coming on every day or so. She had never had chills nor attacks of vomiting with the pain. There had never been blood in the

urine, nor any increase in frequency of micturition. Urination had never been painful.

The patient, upon admission, was in good physical condition. The abdomen was soft; there were no masses, and no tenderness could be elicited. The urine was clear, amber, acid, with a specific gravity of 1016; it contained neither albumin nor sugar.

Operation, August 18, 1910: The kidney was exposed and opened in the same manner as before described, and a rough, dark-colored stone, about one-quarter inch wide and three-quarter inches long, was removed. The patient's convalescence was uneventful, and she left the hospital on the fifteenth day free from pain.

Dr. Johnson's fourth case of renal calculus was that of a man, 27 years old, an elevator operator, who was admitted to the New York Hospital on August 24, 1910, complaining of pain in the left flank and radiating down into the left scrotum. His family history was negative. On July 25, 1910, he had submitted to an operation for chronic catarrhal appendicitis. Upon his recovery from this operation he still complained of occasional severe attacks of pain in the left flank. There was no history of blood in the urine at that time.

The patient stated that since early childhood he had suffered from occasional attacks of severe pain in the left flank, radiating downward into the left testis. The pain had always been severe and cramp-like in character, doubling him up, usually lasting a few minutes and then gradually passing away. There was no history of vomiting nor fever. Formerly the attacks occurred once or twice a month, but since his operation for appendicitis they had increased in severity and frequency, sometimes occurring several times during the day. Recently there had been a burning pain in the penile urethra on urination, with a diminution in the quantity of urine passed. There was no increased frequency.

The patient, on admission, was well developed and nourished. His abdomen was soft and no masses could be felt. There was extreme tenderness in the left flank over the kidney area, both anteriorly and posteriorly. The kidneys were not palpable. An X-ray, which was taken prior to his discharge after his operation for appendicitis, was negative. A second one, taken just prior to his present admission, was positive, showing a shadow in the left kidney area.

On admission the patient's temperature was 98.4; pulse, 90;

respirations, 20. The urine was clear and amber, acid, with a specific gravity of 1020, and contained neither albumin nor sugar.

Operation, August 25, 1910: Technic as before described. A stone about the size of a bean was removed from the upper part of the renal pelvis. The patient's convalescence was uneventful, and he left the hospital on the eighteenth day. He was then still rather weak and anæmic, but free from pain.

Dr. Johnson said that in all of these four cases the kidney was found to be practically normal. The stones, evidently, had not caused any serious change in the kidney substance in spite of the fact that they had been there for a long time.

DR. CHARLES N. DOWD asked Dr. Johnson what success he had had in removing stones through the pelvis of the kidney. Personally, he had done this several times with better success than through the cortex.

DR. JOHNSON said that under favorable conditions the removal of a stone through the pelvis of the kidney was a very proper procedure, but it was one that could not always be executed with perfect safety nor satisfaction. We could not always tell in what part of the pelvis or in which of the calices the stone lay. He recalled one such case where a small stone was located in the pelvis, where it could be felt very distinctly. Wishing to free the kidney a little more, he let go of it for a moment and he subsequently lost trace of the stone and found it had slipped into one of the calices and could not again be located until the kidney itself was incised. Another point to bear in mind was that we may be dealing with multiple calculi, some of which were not shown in the X-ray plate, and could only be located by careful palpation or incision of the kidney itself.

In answer to a question, Dr. Johnson said he always delivered the kidney sufficiently to get hold of the pedicle between his fingers. A clamp could then be applied, which would not only fix the organ, but at the same time control the hemorrhage.

THREE CASES OF UNILATERAL LAMINECTOMY WITH DORSAL ROOT SECTION FOR THE RELIEF OF SPASTIC DIPLEGIAS AND HEMIPLEGIAS.

DR. ALFRED S. TAYLOR presented a boy whose case was originally one of cerebral diplegia, with increased knee jerks, Babinski and the typical "scissor" gait. Dr. Taylor did a unilateral laminectomy and divided the last dorsal and portions of

the posterior lumbar roots on the left side. Since then the patient had received regular physical training to correct the inco-ordinate movements which remained in these cases after operation, and which were doubtless remnants of the former vicious excessive reflex action, perpetuated through mental conscious or unconscious association. Under this system of training the boy had made considerable definite progress. He was able to walk with head and trunk erect and keep his arms by his side. He walked with a narrower base than formerly, although the side swaying continued. His gait was much better when walking slowly than when his pace was quickened. The patient's self-confidence had greatly increased, and his ambition had been aroused. This being the first case of the series, only a few roots were divided to see what the trophic and functional results might be.

Case II was that of a boy, 18 years old, whose right side had been paralyzed from birth. The case was one of infantile cerebral hemiplegia. He had had epilepsy since he was eight months old. At first his attacks were truly hemiplegic, beginning in the arm on the affected side. The whole body was affected. The right arm was spastic in the shoulder, arm, forearm and hand. Permanent contractions of the abductors of the arm, biceps, and long flexors of the fingers were present. The shoulder and arm were the seat of a mild grade of athetotic movements.

An operation was done on November 15, 1909, by Dr. Taylor, to overcome the spastic state and to note the influence of such operations upon the epilepsy and athetosis. Spinal hemilaminectomy was done, the posterior cervical nerve roots from the fourth to the seventh, inclusive, being resected. No specific anæsthesia followed the operation. All spasticity was removed, but the athetotic movements were increased for ten days after the operation; then they disappeared entirely, and they were still absent in large part. As to the effect of the operation on the boy's epilepsy, there was a record of 41 fits in 1907; 51 in 1908. In 1909, up to the date of the operation in November, he had had 160 attacks; since then the number had been reduced from fifteen per month to six per month without the aid of bromides. The violent and explosive laughter to which the patient had formerly frequently given way had also been modified in character. The patient was under physical training and orthopædic care for the contractures of the arm.

Case III was that of a boy, 18 years old, who was a typical example of an infantile hemiplegic. The left arm and leg were moderately undeveloped, the left forearm was contracted on the arm at an acute angle, and the hand was flexed at more than a right angle on the wrist. The fingers were in extension, and could just be moved. The patient was feeble-minded.

On November 8, 1909, Dr. Taylor did a unilateral laminectomy and resected the posterior cervical nerve roots from the fourth to the seventh, inclusive. By the operation the arm was entirely freed from spasticity, and if the permanent contractions could be overcome it would doubtless assume its natural and normal position. Under physical training and orthopædic appliances, the arm had improved, and the patient was now able to move his fingers, although the muscles had lost all power of contraction.

Dr. Taylor said the most interesting feature of these cases, from a surgical stand-point, was the freedom from injury or deformity of the spinal column as the result of the unilateral laminectomy. The spinal column at present showed no lack of flexibility, either anteroposteriorly or laterally. The speaker stated that as the result of his experience he was convinced that it was not necessary to divide all the posterior roots in order to relieve the spasticity in these cases; on the contrary, only a part of the sensory roots had to be divided, and by doing this we relieved the spasticity without the danger of producing ataxia or trophic disturbance.

These three cases, Dr. Taylor said, were from the service of Dr. L. Pierce Clark, who had shown them at a meeting of the New York Neurological Society last spring.

ENDOTHELIOMA OF THE SOFT PALATE.

DR. TAYLOR presented a woman, 29 years old, who, when she came to the Vanderbilt Clinic in 1901, gave a history that for several months she had felt a small lump on the right side of the soft palate. This had never caused her any pain, and she was simply conscious of its presence by the tongue impinging on it. The growth at that time was about the size of a hazel-nut; it was excised without much hemorrhage and the wound healed very satisfactorily. The pathologist reported that the growth was an endothelioma. It recurred in August, 1902, and was again removed, both operations having been done under cocaine anesthesia.

There was a second recurrence in February, 1904, and at this time the growth was located a little further forward and slightly involved the periosteum. It was again removed, this time under chloroform, and after this operation an aperture, about 2 cm. in diameter, was left in the soft palate. This diminished in size within a reasonably short time until it was scarcely perceptible.

In October, 1904, about eight months after the last operation, a small recurrence was noticed, this time on the hard palate. The entire old scar was removed, the periosteum was dissected well forward on the hard palate, the growth was excised within a safe margin, and a thorough application was made with the Paquelin cautery. This operation left a hole in the soft palate about an inch and a quarter in diameter, which also closed satisfactorily within a short time. Since that operation, a period of over six years, there had been no further recurrence. In every instance the recurrent tumor was pronounced an endothelioma.

FRACTURE OF THE TRANSVERSE PROCESS OF THE SEVENTH
CERVICAL VERTEBRA, WITH PARALYSIS OF THE
EIGHTH CERVICAL AND FIRST DORSAL NERVES.

DR. TAYLOR presented a young man, 20 years old, who had always been in good health, and whose family history was unimportant. On September 11, 1910, while riding in a velodrome on a motor cycle going about 60 miles an hour, he was thrown off, and while in the act of getting up he was struck on the head, neck and shoulders by an oncoming motor cycle and was rendered unconscious.

Soon after the accident his pulse was 150, small and thready; the left pupil was dilated and did not react to light; the right was contracted. There was neither bleeding nor escape of cerebrospinal fluid from the ears or nostrils. The sixth and seventh ribs on the left side were fractured in the midaxillary line. This was followed by extensive cutaneous emphysema and hydropneumothorax. There was retention of urine, which persisted for three days, and a low muttering delirium for two weeks following the accident.

On the fourth day after the injury it was noted that he did not use his left arm. On the sixteenth day he was well oriented as to place and person, and complained of pain in the arm. An examination made on the thirteenth day showed loss to all forms of sensibility over the areas supplied by the seventh and eighth

cervical and the first dorsal spinal roots. There was weakness of the triceps, the extensors of the wrists and fingers, the pronators, pectoralis major and latissimus dorsi; paralysis of the long flexors of the wrist and fingers, the muscles of the thenar and hypothenar eminences, and the flexor carpi ulnaris. The sensory symptoms referable to the middle trunk cleared up rather rapidly, and were probably due to a very slight pressure interference which did not persist.

A skiagram, taken on September 30, 1910, by Dr. C. F. Baker, showed a fracture of the transverse process of the seventh cervical vertebra, with downward displacement of the fragment. At this time the patient began to complain of severe cramps in the affected muscles. Before operation the persisting symptoms were characteristic of the lower arm type of brachial plexus palsy, or Klumpke's paralysis. With these were associated well-marked symptoms of palsy of the sympathetic fibres.

Operation by Dr. Taylor on November 1, 1910: Upon dissection of the brachial plexus, just above the eighth cervical root, one could feel a small, loose fragment of bone which had been depressed upon that root. The first dorsal root was not injured, so far as could be judged, and the fifth, sixth and seventh cervical roots were also normal.

The loose fragment of bone was dissected out between the seventh and eighth cervical nerves, and it was found necessary to carry the dissection behind the entire brachial plexus to avoid doing injury to the roots of the plexus. The fragment was finally enucleated, and the operation was followed by considerable relief from the painful muscle cramps which the patient had experienced.

SARCOMA OF THE TENDON SHEATH OF THE FLEXOR LONGUS POLLICIS MUSCLE.

DR. JAMES I. RUSSELL presented a woman, 32 years old. She was married, and her occupation was that of a seamstress. Her family history as well as her past history had no bearing on her present illness.

Three and a half years ago, after the patient had been ironing all day, she noticed a round, reddish spot on the right thenar eminence. It did not cause her any pain, but the hand felt tired. This redness persisted for about a week, and within that time a

swelling developed, followed within six months by similar but smaller hard nodules on the palmar aspect of the phalanges of the thumb. No other nodules formed until two years ago, when one appeared on the flexor surface of the wrist just above the annular ligament. There had at no time been any pain or inflammation, and the patient had used the hand regularly, suffering from mechanical inconvenience only. Examination showed that these tumors were very hard, and not tender. They moved freely, and were apparently not intimately attached to the tendon sheaths. The skin rode freely over them.

Operation: An incision was made beginning at the fold between the phalanges and carried upward along the course of the flexor longus pollicis tendon to the base of the thenar eminence. The skin and subcutaneous tissues being retracted, the largest of the tumors was dissected away from the surrounding tissues, and removed with the tendon sheath, with which it was intimately connected. By raising the skin, the small nodule on the palmar surface of the distal phalanx and one somewhat larger on the ulnar side of the proximal phalanx were removed. A second incision was then made, beginning opposite the upper border of the annular ligament and carried up the forearm one inch. The flexor longus pollicis was located and the nodule dissected away from it, the sheath being also removed, and a few small nodules lying on the tendon sheath were removed from beneath the annular ligament between the two incisions. The wounds were closed with silk sutures, and two rubber tissue drains were inserted. The patient's recovery from the operation was uneventful. The pathologist reported that the growths belonged to the type of mixed-cell sarcomata.

SARCOMA OF THE HUMERUS.

DR. WILLIAM B. COLEY presented a man, 30 years old, who was referred to him on June 15, 1910, by Dr. J. M. T. Finney and by his family physician, Dr. W. A. Fisher, both of Baltimore, Md., with the history that he had received an injury to the left shoulder two years ago. On December 30, 1909, he sustained a spiral fracture of the humerus at the junction of the upper and middle third. Union took place in the usual time, but severe pain persisted. On May 25, 1910, an X-ray showed what appeared to be a sarcoma in the upper end of the arm and extend-

ing to the head of the humerus. The case was referred to Dr. Finney, who curetted the new growths.

When Dr. Coley first saw the patient, on June 15, 1910, the upper third of the left humerus was markedly enlarged, and at the junction of the upper and middle third there was evidently a pathological fracture, giving a well-marked flail joint. On the anterior and inner aspect there was a recent cicatrix five inches long, in the centre of which there was a large opening extending into a cavity the size of a goose egg, which was packed with gauze. The clinical appearance was that of a bone sarcoma which had been partly removed by curetting. The X-ray photograph showed unmistakable evidence of sarcoma of the humerus, with marked enlargement of the bone and destruction of a large part of the osseous structure. The disease, apparently, extended up to the head of the humerus. The patient had practically no power in the arm, and suffered great pain.

Dr. Coley immediately put him on the mixed toxins of erysipelas and *Bacillus prodigiosus*, and after three treatments the severe pain, which had prevented him from sleeping more than two or three hours at night, entirely disappeared and has never returned. The injections were made chiefly into the pectoral region, but every third or fourth time into the tumor itself. The latter injections, in doses of four or five minims, usually produced a chill, followed by a temperature of 103 or 104. The highest dose given in the pectoral region was nine minims.

The effect of the treatment upon the tumor was shown by a slow but steady decrease in the size of the humerus at the site of the growth. The large cavity gradually filled up with new tissue. The shell of bone surrounding the tumor, which at the beginning of the treatment was entirely broken across, gradually became harder by the new formation of bone, and in two months firm union had occurred.

Early last August, Dr. Coley said, he allowed the patient to return to Baltimore, where the treatment was continued by Dr. Fisher. In September the granulations increased and assumed a sarcomatous type. These were curetted, and an examination of the tissue removed showed it to be spindle-celled sarcoma. The patient returned to New York by the middle of September and was under treatment by Dr. Coley and his associate, Dr. Gillespie, for a period of three weeks, most of the injections

being made into the arm. A third X-ray picture was taken, which showed increasing new bone formation of more normal appearance. The cavity was much smaller than at first, and the granulations seemed healthy.

On October 7, 1910, after all treatment had been suspended for about two weeks, Dr. Fisher again found the granulations suspicious and made another curettement. Microscopical examination of the tissues removed on these three different occasions showed the same type of sarcoma (spindle-celled). The examinations were confirmed by Dr. James Ewing, of the Cornell Medical College, whose report reads as follows:

"The tumor has the general structure of a large, spindle-celled sarcoma. Some portions of the tumor are very rich in cells which are most abundant about irregular blood sinuses, and they are often arranged in interwoven bundles after the manner of smooth muscle bundles. The cells are mostly of long, plump, cylindrical form, but many are short and nearly round, and some of these round cells are of giant size, with huge multilobed nuclei. Mitoses are abundant. In some oedematous areas all the cells are round and hydropic, and when the cell bundles are cut in cross section, they appear round and resemble the cross section of smooth muscle. In the cellular areas the stroma is scanty or absent; elsewhere it is abundant and often hyaline. There are considerable areas of fibrosis, and some portions are necrotic. The histological appearance indicates considerable malignancy. The diagnosis is large, spindle-celled sarcoma, with giant cells, and the origin is very probably from muscle."

The patient returned to Dr. Coley on October 15, and the toxins were resumed in as large doses as could be tolerated without too much depression. Under this treatment the cavity finally healed by healthy granulation, the arm had almost fully recovered its normal function, and the patient's general health was good.

A ROUND-CELLED PERIOSTEAL SARCOMA OF THE FEMUR INVOLVING THE LOWER TWO-THIRDS OF THE SHAFT, WITH EXTENSIVE PECTORAL AND ABDOMINAL METASTASES; WELL EIGHT AND A HALF YEARS AFTER TREATMENT.

DR. COLEY showed this patient, who had been treated with the mixed toxins of erysipelas and *Bacillus prodigiosus*, and who was well eight and a half years after treatment. The patient

had been referred to him by Dr. Wisner R. Townsend of the Hospital for the Ruptured and Crippled, on February 5, 1902. Physical examination at that time showed a large tumor occupying the entire lower two-thirds of the left femur. It was fusiform in shape, with its largest circumference just above the condyles. A portion of the tumor was removed under ether anæsthesia, and found to be a periosteal sarcoma. The diagnosis of sarcoma was confirmed by microscopic examination made by Dr. E. K. Dunham, Director of the Carnegie Laboratory, Professor of Pathology at the Bellevue University Medical School and Pathologist to the General Memorial Hospital, and also confirmed by Dr. B. H. Buxton, of the Loomis Laboratory and the Cornell Medical College.

Hip-joint amputation was strongly urged, but refused by the patient and his parents. Under prolonged X-ray treatment, there was at first some diminution in the size of the growth, but in the fall of 1902, the patient developed a metastatic tumor in the left pectoral region; this was six inches in diameter and two inches in thickness. About the same time a large tumor, the size of a child's head, developed in the iliolumbar region on the right side; this filled the entire iliac fossa, and extended up to the ribs, being probably connected with the ilium. The patient was then put upon large doses of the mixed toxins for the first time. In about four weeks the tumor in the iliolumbar region began to soften and break down. Under ether anæsthesia an incision was made in the lumbar region and a large quantity of necrotic tumor tissue, between a pint and a quart, was evacuated. A tube was kept in for a long time, and more or less drainage continued for nearly a year. The patient's general health began to improve, and the tumor involving the femur slowly decreased in size.

This patient, Dr. Coley said, had remained in perfect health up to the present time, a period of over eight years. Examination at present still showed a certain amount of thickening of the left femur, and a very marked X-ray dermatitis, which, from time to time, showed areas of ulceration.

Dr. Coley said that a cure of a subperiosteal sarcoma of the femur, even by hip-joint amputation, was exceedingly rare. Butlin found only one cure in 68 cases of hip-joint or high amputation. The case reported was of added interest from the fact

that it was the only case on record of periosteal sarcoma of the femur with extensive metastases cured by any method of treatment.

TUMORS OF THE HAND AND FINGERS.

DR. WILLIAM DARRACH read a paper with the above title.

DR. COLEY recalled the five following cases of malignant tumors of the fingers or hand that had come under his personal observation.

Case I, which had already been referred to by Dr. Darrach, was a sarcoma of the metacarpal bone immediately following a trauma. The arm was amputated three months after the injury. General metastases in the breast and liver occurred four weeks later, and death six weeks afterwards.

Case II was a round-celled, periosteal sarcoma of the ring finger in which the tumor was imperfectly removed, it being thought that it was a fibroma. A microscopical examination made by Dr. William Welch, of the Johns Hopkins University, proved it to be a highly malignant periosteal sarcoma. Before amputating the finger, it was decided to try the mixed toxins, which were given, chiefly systematically, for four months. The tumor disappeared, and the patient was now well more than ten years.

Case III was a spindle-celled sarcoma on the hand of a girl twenty years of age, originating in the fascia. The tumor was removed, but recurred. It then disappeared under the mixed toxin treatment and the patient remained well for about two and a half years, when it recurred locally and grew very rapidly. Amputation was at once advised, but the patient refused and took Christian Science treatment for eight months, at the end of which time the hand had attained the size of a cocoanut. She then returned for amputation, which was done, but which did not prevent death from general metastases two months later.

Case IV was a central sarcoma of the giant-celled type involving the little finger of a woman about 50 years of age. The growth was the size of an English walnut. The finger was amputated, and the patient was well when last heard from, about ten years later.

Case V was a melanotic sarcoma starting about the thumb-nail immediately following an injury to the thumb caused by a heavy office curtain cord bruising it. The swelling was at first supposed to be an abscess, and was lanced. Later, it was removed by

operation. A few months later a number of small subcutaneous melanotic tumors appeared in the forearm and arm, and within the next year hundreds of tumors appeared in different parts of the body, the patient finally dying from a metastatic growth involving the spine.

Stated Meeting, held November 23, 1910.

The President, DR. ELLSWORTH ELIOT, JR., in the Chair.

EPITHELIOMA OF THE NOSE OPERATED ON UNDER INTRATRACHEAL INSUFFLATION ANÆSTHESIA.

DR. NATHAN W. GREEN presented a man, 78 years old, who was operated upon by Dr. H. H. Janeway and himself for an extensive epithelioma involving part of the left and practically all of the right side of the nose, the resulting defect being covered by a skin flap taken from the cheek on the right side.

There was nothing of special interest in the operation itself, Dr. Green said, but the case was shown merely because the operation was done under intratracheal insufflation anæsthesia. This was for the purpose of giving an undisturbed narcosis, and of preventing the inspiration of blood and bloody froth into the trachea. In this respect it proved all that Dr. Meltzer had claimed for it, for much blood gravitated into the pharynx, and it seemed to be an ideal method for artificial respiration. There was no post-operative respiratory complication.

EXTENSIVE PERICYSTITIS.

DR. A. V. MOSCHCOWITZ presented a man, 64 years old, who had been subjected to suprapubic aspiration of the bladder four weeks ago. On palpating the abdomen, there was found a very firm, painful, and tender mass extending from the symphysis pubis to within two inches of the umbilicus. In general, this mass had somewhat the shape of a pregnant uterus, with an upper rounded border and its sides tapering downward toward the symphysis; as if it were confined by the outer edges of the sheaths of the recti. It could also be made out that this large mass was intramural and not intraperitoneal. The prostate was very large, approximately the size of a large fist. The patient had a mod-

erate temperature, 100° F., and the pulse-rate was not accelerated. The mass did not fluctuate, and exploratory aspiration at one point was negative.

From the history and physical signs, Dr. Moschcowitz was of the opinion that he was dealing in this case with an extensive cellulitis of the space of Retzius, the infection being of a low degree of virulence. For the present, the treatment was expectant. If suppuration became evident, an incision would be made.

PISTOL-SHOT WOUND OF THE ARM, WITH INJURY TO THE MEDIAN NERVE AND THE DEVELOPMENT OF A FALSE ANEURISM.

DR. VOSBURGH presented a man, who was admitted to Bellevue Hospital in the service of Dr. Bern Gallaudet on October 7, 1908, with a pistol-shot wound of the upper arm. About a week after the receipt of his injury the arm became markedly swollen, and examination showed a pulsating tumor which was recognized as a false aneurism. This diagnosis was verified on operation, and it was also found that the median nerve had been partially divided by the bullet, *i.e.*, connective-tissue sheath intact, but nerve severed, with complete loss of function, both motor and sensory, in the distribution of that nerve. Two years after operation function is now restored, all but some slight anæsthesia over the digital distribution of the median; this without suture of the nerve, regeneration having taken place along the connective-tissue sheath.

DR. F. KAMMERER said the result in Dr. Vosburgh's case was an illustration of the fact that we should not immediately resort to suture of a nerve after injury. The speaker recalled similar cases in which the symptoms of nerve injury persisted for many months, and where non-interference resulted in perfect restoration of function. In one case of unrecognized dislocation of the head of the radius, with consequent pressure upon both branches of the musculospiral nerve, it was found, on operation three months after injury, that the nerves had been reduced to mere strands of connective tissue at the points of pressure. The head of the radius was resected and ultimate complete recovery and restoration of function took place. Where there had been an open wound at the time of the injury, suture of the nerve seemed the

rational procedure, but in cases of loss of nerve function after severe contusions, it is occasionally difficult to decide whether operation is indicated or not.

IMPERMEABLE CARDIOSPASM SUCCESSFULLY TREATED BY THORACOTOMY AND ŒSOPHAGOPLICATION.

DR. WILLY MEYER presented a woman, 47 years old, who had suffered for several years with difficulty in deglutition, with occasional regurgitation. At times, her condition was better, then worse, until she was unable to swallow even fluids. She went to the German Hospital, where an ineffectual attempt was made to pass a dilator. Sounds and X-rays disclosed the presence of a large œsophageal pouch above the cardia.

The patient was fed per rectum for a time, and later a gastrostomy was done. Her condition gradually became worse, and an attempt was made, with the aid of the ureter-cystoscope, introduced through the gastrostomy wound, to pass an instrument upwards through the cardia. This also failed.

On May 31, 1910, under differential pressure, Dr. Meyer did a thoracotomy. He made the lower half of the Schede incision, and turned the flap upwards. The pleura presented many adhesions, and upon incising it and attempting to strip it off, two tears in the lung tissue occurred. These were sutured.

Upon exposing the œsophagus, a very large œsophageal pouch was found lying directly on the diaphragm. The cardia was then drawn into the pleural cavity and palpated; there was no constricting tumor. After blunt exposure of the œsophageal pouch, a strip of gauze was passed around, in order to get a firm hold of it, when it was possible to pass a sound from the mouth through the constricted cardia, under the guidance of the hand, within the thorax. In order to avoid constricting the pneumogastric nerves, they were bluntly stripped off on each side, and the diameter of the œsophageal pouch was materially reduced by infolding its wall twice with the help of interrupted silk sutures.

During the patient's convalescence she developed a partial emphysema, which necessitated rib resection on the twentieth day. During the fourth week she developed a hæmatogenous infection of the right kidney, probably due to a cortical embolism with infection of the perirenal tissue.

Within three weeks after the operation the patient could take liquid nourishment, and was soon able also to swallow solids.

After this operation, if this spontaneous return of easy deglutition should be seen again in similar cases, it would mean a cure of this trouble with the help of thoracic surgery. So far it had been attacked by the abdominal route only (V. Mikulicz, Wendel). It would perhaps also throw some light on the etiology of the trouble, for it seems that the separation of the nervi vagi from the œsophagus, and with it the tearing of the many fine filaments that enter the wall of the œsophagus, might have been the principal factor in stopping the spasmodic contraction of the cardia.

PARTIAL GASTRECTOMY FOR CARCINOMA: THREE CASES.

DR. CHARLES H. PECK presented a man, 47 years old, who was admitted to the Roosevelt Hospital on March 29, 1910. He had had distress after eating for two years, with eructations, a feeling of weight, and dull epigastric pains, which were relieved by vomiting. As his symptoms increased, he vomited after each meal, the vomitus sometimes containing particles of food taken the previous day. There was no history of vomiting blood nor coffee-ground material; no tarry stools. He had lost about 55 pounds in weight during the five months prior to his admission. On March 30, 1909, an examination of the stomach contents showed a trace of blood. There was no bile; free hydrochloric acid, 10. Glycyltryptophane test positive.

As prolonged treatment by competent internists failed to give him more than temporary relief, he was operated on by Dr. Peck on March 31. An indurated growth was found at the pyloric end; this nearly encircled the stomach, with its right margin extending to within 3 cm. of the pylorus, which was free. The lymph-nodes of the pyloric group and those along the greater curvature were extensively involved, and there was a nodule in the upper border of the pancreas. No other metastases were found. The nodule in the pancreas gave rise to some doubt as to the advisability of excision of the growth, but as it was softer than the stomach growth and the lymph-nodes, its character was uncertain, and a radical extirpation was done. Partial gastrectomy was performed, with extirpation of the glands and the pancreatic nodule. The lines of section and the technic followed were those of the typical Mayo method. Posterior gastro-enterostomy by suture with the short loop was then done, and inad-

vertently the anastomosis was made in front of the transverse colon. It was of some interest to note that there had been no obstruction nor unfavorable symptoms either in the early or late convalescence of the patient, in spite of this error.

A cigarette drain was carried down to the stump of the duodenum, as its closure was difficult and not quite satisfactory. No leakage occurred. Time of operation, one hour and fifteen minutes.

The pathological report showed a very cellular type of carcinoma of the stomach, the lymph-nodes, and the nodule from the pancreas. Water by the mouth was given at the end of twenty-four hours, liquid nourishment on the third day, and soft diet on the seventh day. The patient was out of bed on the fourteenth day, and left the hospital well 25 days after operation. He was then eating regular meals without distress, his bowels were acting well, and he had begun to gain in weight. His weight on admission to the hospital was 122 pounds; he now weighs 165 pounds, has no distress after eating, and feels perfectly well.

The second patient was a man, 37 years old, who was admitted to the Roosevelt Hospital, Medical Division, in the service of Dr. Evan Evans on April 15, 1910. The history obtained was that for about one year he had suffered from pain after meals, relieved by vomiting. The vomiting usually occurred about two hours after eating, and sometimes showed particles of food eaten on the previous day. No history of blood or coffee-ground material. Stools constipated, and at times tarry. The patient had lost 54 pounds in weight in the last year, most of it during the past three months. Lavage showed marked stomach dilation and food retention. The gastric contents contained free hydrochloric acid 6, combined 30; total, 42; no lactic acid. Test for blood positive; glycytryptophane test positive.

The patient's emaciation and weakness were so marked that he was transferred to the Surgical Service as an emergency case on September 15, and operated upon at once. He was literally starving and suffering greatly from dehydration.

Upon opening the stomach, an indurated mass was found occupying the pyloric portion; the glands of both the lesser and greater omenta and the pyloric group were extensively involved, and posteriorly the mass was adherent to the pancreas. A partial

present weight is 184 pounds, and his average weight for the past five years was 173 pounds.

The pathological examination showed adenocarcinoma, with a good deal of associated inflammation.

CARCINOMA OF THE CÆCUM.

DR. PECK presented a man, 44 years old, who was admitted to the Roosevelt Hospital on February 24, 1910.

During the month prior to his admission to Roosevelt Hospital, he had tarry stools four or five times, and occasionally noticed a lump in the right iliac region. He had lost only four pounds in weight in six months.

Upon examination, a definite mass, the size of a hen's egg, could be felt in the right iliac region. It was slightly movable, dull on percussion, and non-sensitive. Blood was present in the stools on repeated examinations.

Operation, February 26, 1910: Upon opening the abdomen, the growth was found to involve almost the entire circumference of the gut at the ileocolic junction, as well as the valve itself and some of the retrocolic glands. It was reported to be a colloid carcinoma. About four inches of the ileum, the cæcum, the ascending colon, and a portion of the transverse colon, together with the mesocolic lymph-nodes were excised. The cut ends of the ileum and transverse colon were closed with purse-string sutures, a side-to-side anastomosis by suture was made, and the abdomen closed without drainage.

The patient's convalescence was uneventful. He was out of bed on the twelfth day, and left the hospital fourteen days after operation. He is now working regularly, his appetite is fair, his bowels regular, and he weighs 126½ pounds, which is a gain of seven pounds since the operation. There were no signs of a recurrence up to the present time.

ADENOCARCINOMA OF THE SIGMOID.

DR. JOHN A. HARTWELL presented a woman, 38 years old, who was admitted to Bellevue Hospital on October 1, 1910, with a history of increasing constipation and blood in the stools extending back over a period of about three months.

Upon examination, a tumor was made out in the abdominal region. It was about the size of a normal kidney, globular to the

feel, and dull on percussion. It was freely movable, its excursions extending from the costal margin down into the pelvis, and laterally from the umbilicus to the lumbar region.

Through a small incision, the tumor was exposed. It was found to spring from the sigmoid flexure of the colon. The entire colon was lifted out of the abdominal cavity; a triangular section of the mesocolon was then excised, together with the tumor and the involved lymph-nodes. The wound healed within eight days, and the patient left the hospital in about two weeks.

Pathologically, the growth proved to be an adenocarcinoma, while the involved glands were inflammatory in character.

LARGE INOPERABLE RECURRENT INTRA-ABDOMINAL SARCOMA FOLLOWING REMOVAL OF A ROUND-CELLED SARCOMA OF THE TESTIS A YEAR BEFORE: DISAPPEARANCE UNDER THE MIXED TOXINS OF ERYSIPELAS AND BACILLUS PRODIGIOSUS.

DR. WILLIAM B. COLEY presented a laborer, 48 years old, whose family history was unimportant, and who gave no history of trauma. He was operated upon at the Mt. Sinai Hospital in September, 1909, by Dr. A. A. Berg, who removed the left testicle for a tumor of several months' duration. A microscopical examination of the growth made by Dr. F. S. Mandlebaum, the pathologist of the hospital, proved it to be round-celled sarcoma.

About six months after this operation the patient began to have considerable pain in the left side of the abdomen. This gradually became more severe, and subsequently a large tumor developed in the left hypochondriac and lumbar regions. The patient was referred to Dr. Coley in May, 1910, by Dr. Berg, of the Mt. Sinai Hospital, as an inoperable recurrent case of sarcoma of the testicle, with a view to using the toxins. He was admitted to the General Memorial Hospital and immediately put upon the injections with the mixed toxins. The initial dose of half a minim was gradually increased up to the point of getting a moderately severe reaction, with a temperature elevation of 102 or 103, which was caused by seven or eight minims. All the injections were made into the gluteal region, and he received five to six treatments a week.

Physical examination at the time of the patient's admission showed a hard tumor about the size of a fist in the left side of the abdomen, about on a level with the umbilicus. The tumor,

which was quite fixed, apparently originated in the retroperitoneal glands.

There was a gradual diminution in the size of the tumor under the mixed toxin treatment, which was kept up until August 29, when the patient was temporarily discharged. On readmission to the hospital September 7, 1910, examination showed that the growth had apparently entirely disappeared, but the inguinal glands on both sides were still enlarged, and the treatment was resumed. On November 3, under ether anæsthesia, Dr. Coley removed the glands to determine if they were sarcomatous or hyperplasia due to the irritation of the gluteal injections. Two glands about the size of a marble were removed from the right side and one from the left, and submitted to Dr. W. C. Clark, the pathologist to the General Memorial Hospital, who reported that they were examples of simple hyperplasia, there being no trace of sarcoma. Under ether examination, no trace of the abdominal tumor could be felt. The patient was steadily gaining in weight, and his general condition was normal. Dr. Coley said he intended to continue the injections for two or three months longer, in order to render a recurrence less probable.

The case was interesting from the fact that it was the only case of sarcoma of the testicle, recurrent in the abdomen, in which the toxins, in the speaker's observation, had succeeded in causing a complete disappearance of the disease. He had had four cases of sarcoma of the testis in which he had used the toxins immediately after operation as a prophylactic; those patients had now been well over three years. He had never cured a case of sarcoma of the testis by operation alone.

EPITHELIOMA OF THE LOWER EYELID.

DR. COLEY presented a man, 38 years old. When Dr. Coley first saw him, February 24, 1910, he presented a cauliflower-like growth covering the entire eye, reaching up to the eyebrow, and extending from the outer to the inner canthus. Three attempts at removal were followed by recurrence. Finally, at a fourth operation done by Dr. Downs, everything back into the ethmoid cells was cleaned out.

OSTEOMA OF THE UPPER END OF THE HUMERUS.

DR. COLEY, who showed this patient, said the case was of interest from the fact that the X-ray picture very closely simu-

lated sarcoma, and the probable diagnosis of malignant disease was made by a very competent X-ray specialist.

The patient, a boy of sixteen years, while exercising on horizontal bars at the gymnasium, felt a very sudden and severe pain in the upper portion of the right humerus. He went home immediately, and an examination by his brother, who was a physician, showed a hard swelling two inches from the upper end of the humerus, on the inner side. At first it was regarded as a fracture, but an X-ray examination was made and showed a bony tumor apparently originating in the periosteum and projecting about an inch from the normal surface. From the X-ray picture alone one would almost certainly pronounce it a sarcoma. Clinical examination, however, showed a very hard, nodular, bone-like swelling just beneath the axillary vessels on the inner side of the right humerus. From the extremely hard consistence of the tumor and the nodular type of the swelling, Dr. Coley said he made the diagnosis of osteoma instead of sarcoma. The growth had undoubtedly been present for a long time without having been noticed by the patient. He was sent to the General Memorial Hospital, and two days later, under ether anæsthesia, a three-inch incision was made over the anterior portion of the humerus, and carried down to the periosteum. The vessels and nerves, which lay directly over the tumor, were strongly retracted inwards until the base of the tumor was reached. This was then chiselled off on a level with the normal surface of the humerus.

The tumor proved to be a hard, bony growth, quite typical of osteoma and showing no resemblance whatever to sarcoma. The wound healed by primary union. The report of the microscopical examination made by Dr. Clark, the pathologist of the General Memorial Hospital, had just been completed. The growth was first decalcified and proved to be a pure osteoma.

SUPERFICIAL INGUINAL HERNIA ASSOCIATED WITH UNDESCENDED LEFT TESTIS.

DR. COLEY presented a boy, 16 years old, who was admitted to the General Memorial Hospital early in November, 1910. He had a tumor about the size of a hen's egg in the inguinal region, just above the internal ring, reaching nearly up to the anterior superior spine. The left scrotum was empty. The testicle could easily be made out, and on coughing a certain amount of omen-

tum was forced into the sac. It was clear that the testicle was covered only by the skin and superficial fascia, thus making the diagnosis of superficial inguinal hernia perfectly easy.

This patient was shown, Dr. Coley said, first, for the reason of the supposed rarity of the condition. Dr. A. A. Berg published an article on this subject a few years ago in *The Medical Record*, according to which only seventeen such cases were reported in the literature. Dr. Coley said the condition was much less rare than was generally supposed. They had operated upon fifty such cases at the Hospital for Ruptured and Crippled, and upon a large number outside of the hospital.

The second reason for showing the case was that it threw an important light upon the etiology of this subject. Formerly, Dr. William T. Bull and the speaker were inclined to regard this type of hernia, as well as the interstitial type, as due to the testicles meeting with an obstruction in the region of the external ring and following the line of least resistance, *i.e.*, upwards. In the present case there was found a bilateral sac, the one pouch extending down to the bottom of the scrotum, the other toward the anterior superior spine, the latter containing the testicle. These sacs, Dr. Coley said, he now believed to be practically always of congenital origin, and not acquired in the way formerly supposed.

The testis in the present case was easily placed in the bottom of the scrotum without sacrificing the vessels of the cord, although he did not hesitate to sacrifice those vessels in cases where cutting the fascial bands alone did not permit placing the testicle in the bottom of the scrotum. Bevan had shown the comparative safety of sacrificing all the vessels of the cord excepting those of the vas deferens.

ANÆSTHESIA BY THE INTRATRACHEAL INSUFFLATION OF AIR AND ETHER.

DR. CHARLES A. ELSBERG read a paper with the above title, for which see page 161. He also demonstrated the apparatus used.

DR. HOWARD LILIENTHAL said he had employed this apparatus in a number of cases, and he could indorse all that Dr. Elsberg had advanced in favor of this method of anæsthesia. It hampered and worried the operator much less than any other method of which he knew. The speaker said his experience with the method was thus far limited to six cases, one an intrathoracic operation, one for the extirpation of a goitre, and the others laparotomy

cases. He could also corroborate what had been said in regard to the remarkable rapidity with which these patients recovered from the effects of the anæsthetic; in one instance where the operation was quite prolonged, the patient, within one minute after the withdrawal of the anæsthetic, protruded her tongue upon request and gave other evidences of being perfectly conscious.

Dr. Lilienthal expressed the belief that the intratracheal insufflation method of anæsthesia would prove of enormous value in operations other than those confined to the intrathoracic cavity. It seemed particularly indicated in cases of intestinal obstruction, as it obviated the danger of fecal vomiting, with the possibility of inhaling septic material into the lung. By this method, should vomiting occur, the vomitus would be instantly expelled through the mouth. This fact, he understood, had been demonstrated on animals by Dr. Meltzer.

One difficulty that he had encountered with the method, Dr. Lilienthal said, was to introduce the tube into the trachea. The technic of this required some practice. He had seen Dr. Elsberg do it in a few seconds.

DR. S. J. MELTZER, after congratulating Dr. Elsberg upon the successful working of his apparatus and the care with which he employed the method of insufflation in operations upon human beings, said that perhaps fifteen years ago he made the observation that artificial respiration was in itself an anæsthetic measure. Others had since made the same observation; it can be demonstrated on animals. Also by the insufflation method this fact can be demonstrated; it contributes to the anæsthesia even when air alone is being used. Dr. Meltzer said he had learned recently that certain animals were more susceptible to ether than others; it had been found necessary in such cases to give them half ether and half air, or even less ether; as soon as this proportion was increased, the animal stopped breathing completely, although the circulation would remain unimpaired.

Replying to Dr. Lilienthal, the speaker said that animal experimentations had shown that there was no danger of inhaling foreign material into the lung with this method of anæsthesia. This had been demonstrated by filling the pharynx of the animal with coal dust and by producing forced vomiting, yet in spite of this the trachea remained free from foreign material as long as the insufflation was continued.

SARCOMA OF THE CHEST WALL REMOVED BY THORACOTOMY UNDER DIFFERENTIAL PRESSURE.

DR. WILLY MEYER showed this specimen, which was obtained from a man, 33 years old, with a tumor of the right chest wall extending from the sixth to the tenth ribs. It was excised under differential pressure and was found to involve the diaphragm, a portion of which had to be removed. The patient died on the morning following the operation. Secondary hemorrhage into the pleural cavity, which had been closed air-tight, was found to have been the cause of death on inspecting the wound. Pathologically, the growth proved to be an alveolar sarcoma.

ANNALS OF SURGERY

VOL. LIII

MARCH, 1911

No. 3

ORIGINAL MEMOIRS.

PARATHYROID IMPLANTATION IN THE TREATMENT OF TETANIA PARATHYREOPRIVA.

BY W. H. BROWN, M.R.C.S. Eng.,

OF VICTORIA, AUSTRALIA.

IN spite of the amount of experimental work done in recent times on the functions of the parathyroid bodies and of the conclusions which this work seems to have established,—so far, at any rate, as their necessity to the bodily economy and the special results accruing from their removal or destruction are concerned,—a search up and down the reports of the meetings of surgical societies in this and other journals during, say, the past year will provide evidence of much skepticism on the subject in the minds of many surgeons. Moreover, in a recent book on the subject (Ochsner and Thompson), after an admirable account of experimental work done on the parathyroid bodies and a clear summing up of the conclusions reached, it is thought necessary to devote a section to the attitude of those unwilling to accept those conclusions. For this skepticism there are perhaps two reasons: one, the difficulty of apprehending the fact of such small and insignificant bodies being charged with such great importance to the health of the body; and the other, the rarity of human (clinical) instances clearly indicating the same facts concerning the parathyroids as have been arrived at by the experimentalists. This latter point,

it seems to me, sufficiently justifies the publication of the following case. If any further justification were needed, I would say, without in any way wishing to exonerate myself from the blame due to a faulty judgment, that it was owing to such skeptical utterances on the part of some prominent surgeons, that the present story is there to tell, with its disagreeable experiences to both my patient and myself.

The patient, a married woman twenty-four years of age, weight about seven and a half stone, came to me first about the middle of 1909. She presented a typical example of Graves's disease, in which all the main signs and symptoms were present. There was a large bilateral prominent goitre; exophthalmos was very marked and symmetrical. The pulse-rate at rest was 90 to 100 and went up to 130 and 140 on the least exertion or excitement. The patient was rather hoarse, owing to a small tumor growing on the front part of the right vocal cord. She was somewhat anæmic, and amenorrhœa had existed for some months; otherwise the history and condition presented nothing special. She had one child about two years old. For several months she was treated by medicine and rest without much improvement, so on October 13, 1909, I removed the right lobe of the thyroid under ether anæsthesia. There was nothing specially noteworthy about the operation. I divided all the vessels as close to their entrance into the gland as I could, but did not see anything of the parathyroid bodies. The adhesions posteriorly were rather beyond the average in strength and extent. The after-course of the case was smooth, the wound healed at once, there were no bad symptoms, and the patient returned to her home about a fortnight later.

Distinct improvement was the result of this operation, and menstruation became normal, yet it was obvious that there was far too much thyroid tissue left, so just six months later, on April 15, 1910, I undertook the second operation. I should say that just prior to this second operation, owing to certain skeptical utterances by leading surgeons in America and elsewhere, I had allowed myself to become imbued with a certain disregard for the parathyroids. This feeling I am certain will never revisit me so long as I live. It was owing to it, however, that at this

second operation I removed nearly all of the remaining thyroid, including, ultimately (though I had not at first intended it), the whole of the very large left lobe and most of the greatly enlarged isthmus. I left only a piece of the isthmus as big as a large walnut at its left lower portion. Extensive posterior adhesions again made the operation a little more troublesome than it sometimes is. Again the immediate after-course was as satisfactory as could be wished, healing took place *per primam*, and in spite of a short sharp rise of temperature on the second and third days the patient's general condition was quite satisfactory.

The operation was on April 15. On the nineteenth the nurse's notes mention "a feeling of stiffness in both hands and the left leg, with feeling as of pins and needles." This continued on and off, but was so slight and appeared to interfere so little with the patient's general comfort and well-being that not much notice was taken of it till the twenty-third, when in the early morning the discomfort became marked; by 10 A.M. the tendency to tetany was quite clear, and I realized the true nature of the trouble. I immediately put her on calcium lactate, ten grains every two hours. In the afternoon there was marked and painful tetany. Chloral hydrate was given (five grains hourly) and she got some relief after the third dose. Retention of urine occurred, making necessary the passage of the catheter during two days.

On April 24 I procured five ox parathyroids (from freshly slaughtered bullocks), made an emulsion from them by cutting them up and then thoroughly pounding them and mixing with normal salt solution. This, strained through gauze, I injected under the skin of the abdomen.

The note on April 26 is, "much better; hands a little stiff if moved." She continued better, and on May 5 left the private hospital to stay with some friends near by. Pulse and temperature are noted normal. I may say here that at the beginning of this tetany trouble, *i.e.*, from April 23 to 25, the temperature was raised, reaching as high as 102.2° F., but never afterwards during the course of her illness.

On May 7 (three days after leaving the private hospital), I received an urgent message, and found her in a terribly severe attack of tetany. The hands and arms were rigid, elbows bent slightly beyond right angles, wrists bent to the utmost extreme, metacarpophalangeal joints flexed as much as possible, fingers

straight and bunched together, thumb straight and drawn in below fingers. The description "obstetric position" of hand fairly applies. The lower limbs also were stiff and straight, the ankles especially being extended to the utmost. She was crying with pain and was a most pitiable sight to behold. She was given chloral hydrate (five grains hourly) and brought back to the private hospital. After three doses of the chloral, considerable relaxation of the stiffness and sleep were produced. Next day (May 8) she remained easier, but on the morning of the ninth an intensely severe attack of tetany occurred. Amyl nitrite was tried but had no effect. At 10 A.M. chloroform was administered in bed (on this and many other occasions it was noticed that chloroform did not tend to relax the tetany; it rather made it worse and sometimes seemed to bring it on when not previously present). She was taken to the operating room and an opening was made over and through the right rectus abdominis to provide a pocket between it and the subjacent transversalis fascia. Into this pocket was now slipped the whole thyroid excised liberally from the neck of a good-sized collie dog, which was ready under chloroform. The openings in muscle and skin were closed. In the evening another severe attack of tetany occurred, during which marked strabismus was noticed. After four doses of chloral (five grains hourly) the patient went to sleep and slept all night. The catheter was required, and nutrient enemata were given owing to the patient's weakness; but no more attacks of tetany occurred till the seventeenth, eight days after the implantation. On this date and next day several slighter attacks occurred, relieved by early administration of chloral. On the evening of the eighteenth, another emulsion made from two parathyroids, procured fresh at the slaughter yards, was injected. This was followed by greatly diminished stiffness and absence of any attack for some days, although her condition was very poor, the notes mentioning (after the twenty-second) occasionally "general stiffness, depression, and weakness; has to be fed."

On the morning of the thirtieth she seemed to be better, feeding herself; but at 4 P.M. she had what is described as the worst attack of tetany up till then. To try and relieve her terrible pain and distress I gave her chloroform, putting her quite deeply under its influence, but without producing the slightest relaxation of the muscles. After administrations of bromide of potassium (gr. xx)

and chloral (gr. xxx) by rectum she slept and had a good night. On the succeeding days she suffered much from stiffness and pain, though without any well-defined attack. On June 2, an emulsion was injected made from five dried parathyroids, which had been kindly procured for me by Dr. Bull, fresh at the Melbourne abattoirs and dried slowly at a low temperature. In contrast to all the administrations of fresh parathyroids, we could not notice any effect from this administration of the dried glands. On June 7 two parathyroids, taken directly from a living dog (under chloroform), were implanted through a small incision, under cocaine, under the left breast. This procured much relief, for some days scarcely any complaint was made, and the patient got up and walked about a little. On June 19 complaints are noted again of frequent transient feelings of stiffness and pain, together with burning feeling in feet and legs. She spoke a little thickly at times, the words running together. The beneficial effect of this implantation (of June 7) lasted till after the twenty-fourth; after this there were more complaints, and the notes say, "always some stiffness, chiefly of arms, but also legs and mouth muscles, also burning feeling in feet and legs." On June 29 one parathyroid (all that could be found) from a chloroformed dog was implanted beneath the left breast. According to the notes this did not seem greatly to benefit her condition.

On July 4 it is noted that there was complaint of twitching in hands and arms and of a tight feeling round heart. This latter was frequently complained of. In the evening of the fourth the hands were very stiff—relieved by chloral (gr. x). On July 8 the note is, "stiffness, burning sensations, no appetite, cramps increasing." On the tenth, "heart very troublesome, pulse small and irregular, difficulty in breathing; had an attack of stiffness, complained of spasm round heart." On July 12 an emulsion made from three parathyroids (bullocks') was injected. On the thirteenth she had a "fit" which I did not see, but which was thus described by the nurse in charge: "face blue, eyes fixed and open, pupils dilated, frothed at the mouth, skin clammy, urine passed involuntarily, unconsciousness complete; during fit, hands flexed backwards at right angles to arms" (the exact reverse of what usually occurred). The condition was only moderately good from the thirteenth to the nineteenth. She complained of cramps at times, but there was no suggestion of any attack of tetany.

On the seventeenth and again on the nineteenth she had doses of pituitary extract, without any obvious effect. On the nineteenth in the early morning she was seized once more with a typical and very severe attack of tetany; the pain was terrible—she wished to be put out of her misery. Two ox parathyroids kept at 32° F. from moment of removal from freshly slaughtered bullock were inserted beneath the breast under chloroform. After this she became much better again, was up, and complained very little till July 28. On this date it is noted, "stiff on waking; eyes felt stiff during day." On the twenty-ninth it is noted, "stiffness increasing." On this date I transplanted from a small monkey, which I had procured some days previously, the whole thyroid with certainly two and probably three of its parathyroids into a space prepared beneath the patient's left sternomastoid muscle.

From this time on there were no more of the definite attacks of tetany, and the patient on the whole was decidedly better. She was very weak and thin, and was troubled with successive small abscesses, two in the eyelids and one in the labium vulvæ. She often complained of pain round heart and burning feeling, chiefly in the legs, but the stiffness was noted as being less, certainly up to August 15. After this date there was more complaint of stiffness affecting arms and legs, also round eyes and mouth; of the burning sensations and the tightness about the heart. On August 26 a twitching of left arm was noted.

On August 27 an opportunity occurred which I had been long on the lookout for, by which I was able to secure for implantation the parathyroids of a human subject almost immediately after death. The donor was a man aged forty-nine, who died of Bright's disease and uræmia. I removed within half an hour after death three parathyroids and (separately) a piece of the thyroid as big as a small walnut, dropped them into normal salt solution at 32° F., and within an hour had implanted them beneath the left rectus abdominis of my patient. From this time on improvement, though slow, was steady and uninterrupted. From September 3 till the twelfth I find the following notes: "sitting up, taking food well, sleeping well; has slight attacks of stiffness lasting a few seconds; is outside most of the day; has tightness round heart occasionally, appearance has improved markedly, some stiffness of legs in walking."

On September 14 she was sent to her home 20 miles away; her weight was six and a half stone.

She called to see me again on October 26; she had gained 15 pounds in weight since the previous date and was very well indeed, with the exception of a certain degree of anæmia (70 per cent.); also that she had not yet menstruated since April. The eyes are still somewhat prominent.

The above account is compiled from the notes of the case carefully kept from day to day. I will now endeavor to give a short analytical résumé of its course, then discussing at greater length symptoms and remedies.

The thyroidectomy (second) was done on April 15.

On April 19, four days later, complained first of nerve symptoms,—stiffness of hands and pins and needles in left leg.

On April 23 had first attack of tetany.

On April 24 had first parathyroid emulsion; much better till May 7, when very bad tetany occurred, relieved by chloral but repeated on May 9—a very bad attack on this date; implantation of dog's thyroid with (presumably) one or more parathyroids; much better till May 17. On this and the next day several slighter attacks of tetany occurred.

May 18: parathyroid emulsion injected; better, and no attack of tetany till May 30, when there was a very severe attack.

June 2: emulsion made from dried parathyroids injected. No benefit noted.

June 7: implantation of two parathyroids from living dog. Great improvement for 12 days.

June 19 to June 29: return of symptoms, slight at first, increasing in severity.

June 29: one parathyroid transplanted from dog. Not much improvement. Less severe attacks of tetany on July 4, 8, and 10. Heart specially troublesome during this period.

July 12: parathyroid emulsion injected. "Fit" on July 13. Condition moderately good with no attacks till July 19, when there was another very bad attack of tetany. Implantation of two ox parathyroids preserved at freezing point.

Very great improvement till July 28 (11 days), when symptoms showed signs of returning.

July 29: transplantation of monkey's thyroid and parathyroids. Very little stiffness for 16 days—till August 15; from this date symptoms increasing again (but with no distinct attacks) till August 27, when human parathyroids were implanted. Steady improvement after this.¹

From the above it will be seen that the distinctive symptoms of parathyreopriva first manifested themselves four days after the thyroidectomy,—which seems to be about the usual time,—though a distinct attack of tetany did not appear till four days later again. After this it appeared to us that the symptoms could be held in check for from 8 to 14 days, but no longer, by the subcutaneous administration (in one way or another) of parathyroid. The relief afforded by implantation (from dogs and oxen) seemed decidedly greater, both as to completeness and duration, than that gained from emulsions.

Now as to the various symptoms which manifested themselves during the progress of the case: The most striking one was, of course, the attacks of tetany, which I have referred to and in some measure described. These attacks never came on quite suddenly, but were ushered in by gradual increase of existing discomfort. They often lasted several hours with varying intensity, ultimately yielding apparently to chloral, the more readily if it were given early. Consciousness was never in the least degree affected by the attacks; but the pain

¹It will be noted that on several occasions thyroid as well as parathyroid was implanted. This was done, especially at first when I did not find it easy to pick out the parathyroids, as offering a quicker and easier method of transplanting at least some of the parathyroids from small animals, such as dogs, waiting under chloroform. Their small thyroids, excised rather widely and with the vessels cut long, were slipped entire into the pockets prepared for them. But, at the thyroidectomy, I had left less thyroid tissue than I usually do, and came to feel anxious lest on this account myxœdema should possibly be added ultimately to the other troubles. That was why, at the final (human) implantation, I took a small piece of thyroid as well as the parathyroids. This case, I think, presents sufficient evidence that it was the parathyroid, not the thyroid, treatment which benefited the patient. Moreover, thyroid feeding (by tabloids) was given a thorough trial without any result.

and anguish during them were terrible to witness. The arms were the most affected, always symmetrically, then also the lower limbs, and commonly the muscles about the mouth and about the eyes. The proptosis seemed worse and pain about the eyes was nearly always complained of. Also cramps at the heart were suffered, and sometimes on these occasions the pulse became, for a short time, weak and irregular. This heart participancy in some of the later attacks gave some anxiety about the immediate outcome.

Apart from these definite attacks of tetany, there were, during much of the time, certain lesser symptoms and signs present. These were mainly related to the definite seizures, the tendencies or conditions being less marked and more transient. For example, the hands when at rest, though not rigid, would fall naturally into the position which they took during the attack; there would be complaint of more or less stiffness. Burning sensations in the legs were common, as also was a "crampy feeling" about the heart. When these signs increased in severity, a definite attack of tetany was, as a rule, to be expected.

The temperature, except on two occasions already noted at the beginning of the illness, was normal throughout.

The pulse was commonly good, varying from 70 to 90—mostly near the lower limit.

The tongue was clean as a rule, and food was nearly always well taken.

The bowels were inclined to be constipated. Constipation with clay-colored motions was thought by one of those in close attendance on the case to result whenever calcium lactate was pushed. Emaciation was not very marked; weakness and anæmia (hæmoglobin down to 60 per cent.) were observed chiefly about the middle period of the illness.

The curious "fit" noted on July 13 was the only instance of unconsciousness, and as I did not see it, I cannot say much about it. Following immediately after a good dose of parathyroid emulsion I wondered at the time whether it could possibly be caused by too great or sudden absorption of this substance.

The Remedies Used.—Of all the various remedies tried, only two proved themselves of real value: chloral hydrate (and in a lesser degree chloretone) as a palliative for the attacks, and parathyroid. With regard to chloral, the good we got from it was undeniable, though sometimes it would seem to fail us when the attacks were well under way before it was given. Five grains half hourly or hourly would often seem to check or mitigate an oncoming attack. Morphia (gr. $\frac{1}{6}$) was given twice for the pain.

Pituitary extract was given three times, but did not seem to have any particular effect on the case.

Thyroid gland substance (Burrough's Wellcome tabloids) was given a fair trial, without any result.

Calcium has had great claims made for it in these cases, and according to the most recent pronouncements (Ochsner) is of the greatest value—is indeed able to take the place of parathyroid. My experience in this case does not enable me in the slightest degree to endorse this opinion. At the first onset of tetany it was given in doses of 10 grains (calcium lactate) hourly and two hourly. This was kept up for some days; and later I returned to it several times, giving it most thorough opportunities of showing if it could help us. It never seemed to do so in the least.

Aperients seemed of some little value, sometimes appearing to lessen the symptoms when constipation was present.

Parathyroid.—This was the one thing on which our experience taught us to rely with perfect confidence for lasting amelioration of the patient's condition. It was not only in keeping off the definite attacks of tetany, but also in greatly mitigating the lesser, more constant troubles (which I have referred to above), and so in most markedly improving the patient's general condition and appearance, that parathyroid proved its value. Emulsions did good, implantations were still better and longer lasting in their effect.

It really was wonderful to see, both to us and to the patient's friends, how a day or two after an implantation all troubles would subside, and the patient would be up and per-

haps walking about, cheerful and even merry. During such periods, until I came to realize their inevitably short duration, I could scarcely refrain from letting the patient go home.

But it soon became clear that to keep the patient thus comfortable, parathyroids would have to be procured and administered about once a fortnight at the outside. Now the procuring of fresh parathyroids, whether from bullocks or dogs, is not a convenient or enjoyable undertaking. Dr. Bull, of the Melbourne University, was kind enough at my request to procure some parathyroids from the Melbourne abattoirs, and to dry them carefully and send them to me. For some reason, however, they proved to be of no use—the only occasion on which parathyroid seemed to entirely fail us. At my earliest implantations I was unaware, while using the parathyroids of dogs or oxen for this purpose, that the cytolytic action of the body fluids on heterologous tissues implanted precluded any hope of permanent success. Later, though aware of this, I still transplanted from those animals because the implantations gave more marked and longer lasting results than the emulsion. It was Professor Osborne, of the Melbourne University, to whom I had applied for any help or guidance he could give me, who suggested the transplantation from a monkey. He thought that the much less remote kinship might possibly allow the transplanted organs to survive, and I am inclined to think his idea a correct one; that the monkey's parathyroids did actually survive longer than those of the oxen and dogs, and might indeed, unaided, have conferred some permanent benefit on the patient. (The monkey, I may say, recovered from its operation, was well for a week, then died three days later from a form of paralysis, after showing some signs of tetany. The wound was soundly healed.) But the chance for human transplantation seemed too good to be lost—offering, as I believed it did, a still stronger hope of happily terminating a most distressing case. Here again I was helped by learning from Professor Osborne that the vitality of removed organs might best be prolonged by putting them at once in salt solution at 32° F. I may say

that, as regards all the implantations, healing was perfect; no suppuration ever occurred.

From the first I made endeavors to procure some parathyroid extract, which I know has been on the market both in Europe and America. Vassale, for instance, worked out a special method of manufacturing it, and by its aid claims to have benefited cases of medical tetany, rickets, and some other diseases. But the Melbourne chemists and their London agents were quite unable to procure any of it. The use of such extracts seems, however, from recorded cases to have been more often disappointing than valuable in cases of tetania parathyreopriva.

What does this case prove? I think it may be modestly claimed that it proves, what, pace the skeptics, was really in no need of proving, that removal of the parathyroids brings about a morbid condition, of which attacks of tetany are one of the most striking manifestations. Also that no remedy, of those I used, really ameliorates this condition, except the administration, in some way, of parathyroid. Is there any hope of the permanent cure of this morbid condition apart from the successful implantation—successful in the sense of their permanent reception and life and growth as part of the body—of parathyroids from another body? I think that the present case as well as the general body of evidence on the subject gives little foundation for any such hope. Haberfeld and Schilder in very recent work, whose main result was to show that accessory parathyroids may exist in the thymus gland, found in three instances (in rabbits) where they gradually, at intervals, removed, as they considered, every bit of parathyroid tissue, that the animals ultimately recovered. This they take to show that the very gradual withdrawal of all parathyroid tissue from the body is not necessarily fatal. This is the only bit of evidence I have been able to find that the body can ever adapt itself to do without the parathyroids. Some results of Kocher seemed to show that the successful implantation of thyroid tissue held the parathyreoprivic symptoms in check; but this experience seems to be at variance with

most experimental results. And the wonder is natural whether the thyroid tissue transplanted did not contain some parathyroid tissue.

Experiments point unmistakably towards the probability of the parathyroids being indispensable to health. A most vivid example is one of Halsted's experiments, where cachexia parathyreopriva, having been artificially produced, was cured by a successful implantation of one parathyroid in a dog. Some time later this body was dissected out, with the result that the dog died in tetany within 24 hours (Ochsner and Thompson). On the human or clinical side, Ochsner, having earlier conceded great value to calcium—a concession which the history of the present case does not justify—yet sums up the whole matter by asserting that the parathyroid bodies are essential to life and that their loss can only be made good by their reinstatement, *i.e.*, successful implantation. In my own case, I believe that the implantation of the monkey parathyroids was the first measure which with any permanence put the patient in a better condition. Possibly the benefit might have been lasting; though one would have much liked to settle that question, I could not resist the opportunity of implanting the human glands.

I would like to acknowledge my indebtedness to Dr. Bull and to Professor Osborne, both of the Melbourne University, for assistance in this case. To the helpful suggestions of the latter I really feel that I owe no small part of the ultimate success.

GASTROSTOMY AS A CURATIVE MEASURE PER SE IN NON-MALIGNANT STRICTURES OF THE ŒSOPHAGUS.

BY JOSEPH RILUS EASTMAN, M.D.,

OF INDIANAPOLIS, INDIANA.

TWELVE years ago, at a meeting of the Berlin Medical Society, some surprising remarks concerning the direct effects of gastrostomy upon cicatricial œsophageal stenosis were made by Professor Ewald.¹ In discussing a report of successful dilatation of a diphtheritic stricture by Rosenheim, he referred to a peculiar observation, which he had made in dealing with such benign stenoses, namely, the remarkable circumstance that cicatricial stricture, for which gastrostomy had been made, nearly always improved steadily after the stomach fistula had been provided and food had been introduced through the fistula instead of through the gullet—that is, the strictures gradually developed a larger calibre without any other treatment whatsoever.

He found that his patients who previously could get only a small amount of fluid through the stenosis began to take more solid foods, and finally were able to eat and swallow almost as they did before the appearance of the stricture. He observed further that, after the gastrostomy, sounds could be passed through a previously impassable œsophagus.

Ewald explained these phenomena in the following manner: After the gastrostomy is made it becomes possible to fill the stomach with food. The pull of the full stomach downward gradually stretches to some degree the elastic œsophagus. Now it is fair to assume that such stretching of the gullet lengthwise would not enlarge the lumen of the tube, but, on the other hand, tend to narrow it. This is true, but, in Ewald's judgment, true only so long as the stomach is full. When the stomach becomes empty the downward pull ceases. Then the pressure of the food mass above the stricture has its effect upon the stretched and more yielding strictured segment.

More compact masses of food may then squeeze through, the food bolus itself acting as a bougie and gradually dilating the narrowed lumen.

Ewald reported two cases in which he had made these instructive observations. In both cases the stenosis had developed upon the basis of œsophageal ulcers, and in each case the passage of sounds in Ewald's hands had become impossible.

I am sure that similar unrecorded observations have been made by many others after gastrostomy in benign œsophageal stenosis. I have had in similar cases experiences precisely similar to those of Professor Ewald.

The explanation of the phenomena given by Ewald, however, can hardly be applied to all cases. I do not assume that he meant it to apply to all cases. After the swallowing of a hot or caustic fluid, the mucosa of the gullet may become deformed in many ways. Among many interesting deforming processes are, for example, the complete tube-cast-like separation of the mucous membrane described by Strauss, of Senator's clinic,² the œsophagitis *dessicans superficialis* of Rosenberg,³ and œsophagitis *exfoliativa*.⁴ In these conditions after the mucosa has become loosened from the underlying tissues and thrown into folds or ridges or pockets, it is easy to understand that the passage of food or of a bougie must be attended with great mechanical difficulty. It also seems fair to believe that the downward traction due to the filled stomach must have the effect, in some instances at any rate, of smoothing the valve-like folds and irregularities of the loosened membrane, thus permitting the passage of food through a previously impassable œsophageal lumen.

It is well understood that the arrest of food above an œsophageal stricture, with plugging of the tube, followed by the futile attempts at contraction and subsequent relaxation of the muscularis, produces in a large percentage of cases a sac-like or fusiform dilatation above the stenosis.*

In such sac-like dilatations, the opening into the stricture

* This reference, of course, does not in any way apply to diverticula, but relates only to the sac-like dilatations unassociated with hernial protrusion of the mucosa through a defect in the muscularis.

below may not occupy a position at the most dependent portion of the sac, the sac sometimes bearing a relation to the gullet like that borne by the crop of a fowl. It is in cases of this kind that traction of the full stomach has occasionally proven a helpful factor, and although it may be somewhat suppositional, it can hardly be called unreasonable to conclude that this is due to the downward traction stretching the sac in such a way as to bring the opening into the strictured segment to a lower point; it being assumed that the tendency of the downward pull is to funnel the sacculation.

Such an effect would be possible only before the œsophagus had become quite tough and thickened by scar formation. The elasticity of the œsophagus in the normal state and in the early stages of stricture must be quite well understood by any surgeon who has attempted to remove a foreign body firmly lodged in the gullet wall with œsophageal forceps. I have pulled such a foreign body lodged at the crossing of the bronchus almost to the level of the cricoid cartilage and pushed it downward very nearly to the cardia, and yet it was not dislodged from the site at which it was imbedded in the œsophageal coats. Such quite common observations as this give evidence of the mobility and elasticity of the gullet. Stretching the elastic œsophagus by the pull of the full stomach tends to smooth out the folds and wrinkles, and facilitates the introduction of the bougie and the passage of food.

Gastrostomy is curative *per se* for another and more important reason. The rest afforded the œsophagus is of the greatest value in allaying the inflammation which precedes or attends practically all benign strictures. This curative influence of gastrostomy has been mentioned by Helferich,⁵ Rosenheim,⁶ Maylard,⁷ Barozzi,⁸ and many others, and has, no doubt, been noted by every surgeon who has made gastrostomy for stricture of the œsophagus. Nevertheless, the value of gastrostomy as a curative procedure *per se* because of the effect of the rest which it affords the inflamed œsophagus is hardly appreciated. In benign stricture of the œsophagus, one can often find evidences of inflammation in every stage,

particularly in the earlier cases of stricture. Soft infiltrations, or harder infiltrations in which are found but few plasma cells and a relatively small proportion of young connective tissue, will, if we are correct in our elementary and established conceptions of inflammation, yield or disappear if rest be provided. Certainly if ulceration be present the passage of food, or what is worse the arrest of food with consequent fermentation, must maintain or increase the activity of the ulcerative process.

The directly beneficial effects of gastrostomy in cases of so-called benign strictures of the œsophagus are not generally recognized nor appreciated.

We have been slow in discarding old estimates, which were developed in the pre-aseptic era when the performance of gastrostomy was attended with considerable danger.

Not a few earnest and progressive surgeons, in dealing with benign œsophageal stricture, think only of gastrostomy when starvation is imminent and the hand of death is upon the patient. Others, like Lejars⁹ and Jacobson,¹⁰ advise strongly against waiting until the hunger death is near before this purposeful and dangerless means of relief is grasped.

Twenty years ago Jacobson said, "that the comparison of treatment by gastrostomy and dilatation can hardly be made, because the former operation has, in such a large number of cases, been performed under most unfavorable conditions. Much too often it has been put off till the patient, scarcely able to swallow liquids, is just kept alive by enemata. Such patients, worn out by the miseries of slow starvation, often with secondary disease and lung and pleural complications, are not in a condition to be submitted to abdominal section, and are not likely to respond to the call made upon their vitality to unite two serous surfaces firmly together, on which depends the success of the operation."

Gottstein¹¹ and Dean¹² are representative of a large class of surgeons who believe that, as an operation of expediency, gastrostomy is not to be recommended, and reserve it as an operation of necessity to prevent starvation.

Rules laid down twenty years ago to govern the choice between gastrostomy and dilatation are misleading. Gastrostomy is so simple and safe that it should not be put off until the patient is scarcely able to swallow liquids and is being kept alive by enemata.

In reading the reports of cases of this kind occurring in the practice of others and observing my own cases, I have frequently been reminded that in those instances in which sounding has been greatly beneficial a gastrostomy had preceded.

Maylard, who says that gastrostomy in stricture is only palliative, makes a significant statement when he adds that the rest given may admit of dilatation being subsequently effective; and Cheyne,¹³ who observes that "when a patient suffering from extensive and impassable stricture is unable to take sufficient food to support life and is brought almost to the verge of starvation, gastrostomy is called for to avert impending death," adds the following instructive paragraph: "It will often be found that the rest given to the œsophagus by the artificial opening into the stomach produces considerable improvement in the stricture, and not infrequently the patient can swallow far better than he could before within as short a time as a fortnight after the operation. This is probably due to the diminution of congestion and spasm given by the rest."

As a summary the directly beneficial effects of gastrostomy upon cicatricial œsophageal stenosis may be arranged as follows:

1. Gastrostomy renders unnecessary the introduction of irritating and fermentable foods into the inflamed or eroded œsophagus, thus influencing favorably the infiltrated gullet wall.

2. Stretching of the œsophagus by the pull of the filled stomach renders more yielding the strictured segment and makes possible dilatation of the stricture by food masses taken by the mouth (Ewald).

3. In the case of valve-like folds and deformities of the mucosa, sacculations and angulations of the œsophageal

lumen, the downward traction of the loaded stomach tends to smooth out these irregularities.

These are curative factors which pertain directly to gastrostomy.

Gastrostomy indirectly favors the relief of benign œsophageal strictures by providing a gastric fistula for the maintenance of nutrition while dilatation of the stricture or other direct treatment, as tubage or cutting, is being carried out, and by providing an avenue for retrograde dilatation or for the practice of Abbe's string saw, Ochsner's doubled catheter, Dunham's bow string technic, etc. In the latter relation to benign stenosis, gastrostomy has an established position, but as a curative measure in itself it deserves interested attention. By this it is not meant that gastrostomy alone will cure benign stricture of the œsophagus. It will, however, influence favorably the course of the process in an unappreciated degree. If an early gastrostomy is useful in malignant, syphilitic, and tuberculous stenosis, early gastrostomy is applicable in cicatricial stenosis for the same fundamental reasons.

In benign stenosis, so long as pulpy, semisolid, or even a portion of solid food can be swallowed, dilatation or tubage should be practised, but when the point is reached where the patient can only swallow liquids, we are slavishly following the teachings of pre-aseptic writers if we do not perform gastrostomy, not only because of its indirect usefulness, but also because of curative value *per se*.

REFERENCES.

- ¹ Berl. klin. Woch., May 30, 1898.
- ² Berl. klin. Woch., Jan. 11, 1904.
- ³ Cen. b. f. Allg., 1892, No. 18.
- ⁴ Deutsch. med. Woch., 1890, No. 46.
- ⁵ Deutsch. Ztschr. f. Chir., June 6, 1898.
- ⁶ Mod. Clin. Med. Dis. of the Digestive System.
- ⁷ Surg. of the Ali. Canal, p. 70.
- ⁸ Considerations zur la gastrostomie, Paris, 1898.
- ⁹ Technik dringlicher Operationen.
- ¹⁰ Surgical Operations, p. 678.
- ¹¹ Keen's Surgery, vol. ii.
- ¹² Encyclopedia Med., vol. viii.
- ¹³ Manual of Surgical Treatment, p. 116.

OPERATIVE TREATMENT OF WOUNDS OF THE HEART.

WITH REPORT OF A RECENT CASE OF BULLET WOUND OF THE HEART, LUNG,
AND LIVER.

BY G. W. W. BREWSTER, M.D.,

OF BOSTON, MASS.,

Assistant Visiting Surgeon to the Massachusetts General Hospital,

AND

SAMUEL ROBINSON, M.D.,

Surgeon to Out-Patients at the Massachusetts General Hospital.

THE reported cases of wounds of the heart show that 71 cases have been successfully sutured, while 106 have been operated upon with fatal result; 11 of the recoveries and 13 of the failures were cases of bullet wound. As the operation is still in a comparatively new field of surgery, and is looked upon as a considerable achievement, it is probable that a large proportion of the successful results have been reported. If, however, some of the failures have not been reported, the mortality of 60 per cent. which the above cases show may be an unduly low one.

From time to time since 1897 cases have been collected and arranged for the purpose of drawing conclusions concerning diagnosis, indications for operation, technic, and after-treatment (Rehn, Wendel, Salomoni, Vaughan, Peck, Grisogono).

The fact that 177 cases have been reported by 134 operators shows that no one individual has had a sufficient number of cases to be regarded as an authority in diagnosis and treatment; and as the infrequency of the injury itself may preclude the possibility of large individual statistics, conclusions must be based upon the study of the various observations. The publication of the following case, therefore, seems justifiable:

CASE I.—The patient was admitted to the Frost Hospital, Chelsea, Massachusetts, on November 17, 1909, on the service of Dr. George Fenwick. He recognized the possibility of operative treatment for wound of the heart, and asked Dr. Brewster to see the case in consultation. The following account of the patient's condition previous to operation is taken from the records and examination made by Dr. Fenwick.

W. K., male, twenty-eight, Russian, in attempting suicide shot himself in the chest.

Physical Examination.—A well-developed and nourished man with symptoms of profound shock. Pallor was marked, the skin was cold and clammy, and the respirations were rapid. No pulse could be felt at the wrist. There was a marked alcoholic odor to the breath.

Over the fifth rib on the left side directly inside the nipple line there was a punctured wound with ragged edges, one-quarter inch in diameter. The surrounding skin within a radius of three-quarters inch was blackened, and outside this area were patches of red and white glistening skin. Heart sounds were indistinct. No cardiac dulness could be made out to the right of the sternum, and the left border of the heart could not be defined. Right chest normal. On the left side there was dulness in the back and axilla, with absence of respiration in the same region. Breath sounds could be heard, however, in the upper and anterior portion of the left chest. The dulness shifted with change of position. No râles were to be heard. The palpation of the abdomen was negative.

As a result of rest in bed and application of heat and salt solution infusion, the patient recovered somewhat from deep shock. The radial pulse became palpable and of fair character. The rate of pulse and respiration increased gradually. Flatness developed over the area of dulness in the left chest, and a few râles appeared in the upper portion of the left lung. No evidences of pericardial effusion could be made out.

The heart sounds became fainter and were heard loudest at the junction of the fifth costal cartilage and the sternum. There had been a slight but persistent oozing of blood from the wound, which seemed to be more constant than could be accounted for by the external wound alone.

It was six hours after the injury when we first examined the

patient. He was unconscious and almost moribund. Rigidity and tenderness were now present in the upper abdomen. There was flatness over the lower half of the left chest, which pointed with almost certainty to an accumulation of blood in the pleural cavity. The picture was that of concealed hemorrhage, and operation seemed to offer the only chance of recovery.

Operation.—After hasty preparation, ether was administered, causing some increase of hemorrhage from the point of entrance. The external wound was then examined, and exploration of the path of the bullet through the chest wall showed no lesion sufficient to account for the hemorrhage. For this reason it was decided to explore the pleural cavity.

An intercostal incision five inches long was now made over the fifth intercostal space, ending at the sternal border, and the pleural cavity opened. Respirations now became more rapid. The lower edge of the upper lobe of the lung was blown forcibly through the intercostal opening at each forced respiration, accompanied by a profuse gush of blood from the pleural cavity. Respirations became somewhat dyspnoëic. The presenting lobe was seized with a clamp and drawn through the opening, thus plugging the wound. To prevent further effects of pneumothorax a tube leading from a tank of oxygen was inserted into the right nostril. The lips were compressed and the left nostril intermittently closed at inspiration and partly opened at expiration. The edges of the incision were now retracted and the lung remained in a state of two-thirds inflation from the stream of oxygen. Dyspnoea did not recur.

Inspection of the thoracic cavity showed that its lower half was filled with blood. A small wound noted in that portion of the lower lobe overlying the cardiac area was not bleeding sufficiently to account for the hæmothorax. A small stream of blood oozing from the cardiac region led to the discovery of a round hole in the left lateral surface of the pericardium. The costal cartilages of the third, fourth, and fifth ribs were now divided and the third intercostal space incised, making a bone flap which was reflected outward. The opening in the pericardium was enlarged with scissors and the heart delivered, exposing a round hole in the anterior wall of the left ventricle. With the heart held in the palm of the hand three catgut sutures were placed in the ventricle wall. During this time blood spurted from the hole in the ventricle at each contraction of the heart.

After the manipulation of placing the sutures, the hemorrhage steadily increased and it was necessary to make a second closure. A considerable amount of blood had been lost in the interval. The final suture was an over-and-over continuous catgut, which seemed to be more efficient than the interrupted sutures which had been applied first. This may have been due to the fact that the tension extended over a larger area of heart muscle. During the introduction of the last suture manual compression of the vessels at the base of the heart was found to control the loss of blood. During the time of the compression the heart contractions became very rapid and weak; while on relief of the pressure there was a noticeable improvement in the heart action.

Although the hemorrhage was completely checked by the final suture, the contractions soon became so feeble that heart massage was necessary to maintain the heart-beat until the opening in the pericardium had been closed. At this moment the contractions became fibrillary in character and soon ceased entirely, at which moment the operation was abandoned.

The following is an abstract from the autopsy report by George B. McGrath, Medical Examiner for Suffolk County, Massachusetts:

The front wall of the chest is opened by a surgical incision in the second intercostal space, beginning near the anterior axillary line, continued forward and downward across the costal cartilages of the third and fourth ribs close to the sternum, thence outward through the fourth intercostal space to a point near the midaxillary line, the incision corresponding in a general way with that on the outer surface of the body. The fifth rib, at a point 3.5 inches from the middle line and at its junction with the costal cartilage, shows an oval, ragged wound about 0.2 in. across, extending through it; the surrounding muscles contain a little sooty substance. Reflection of the divided ribs shows the opened pericardial sac and the exposed outer border of the left ventricle, upon which is a ragged wound closed by several sutures.

Thorax.—Height of diaphragm fourth rib on right side, on the left indeterminate.

Pleural Cavities.—Left: contains 500 c.c. of firm, currant-jelly-like clot; the left lung collapsed; the inner surface of the lower lobe on its lower border shows a laceration about 1.5 inches across; the lower surface of the lobe close to its lower border and near its inner surface shows an oval, lacerated wound 0.2 x 0.4 inch, immediately opposite which on the posterior and inner surface of the lobe is a similar wound of the same size; the mesial surface of the parietal pleura close to the diaphragm shows an oval wound about 0.3 inch in diameter, surrounded by a region of sub-

pleural hemorrhage about 1.5 inches across; the pleural surface of the diaphragm immediately opposite this point and 0.7 inch to the left of the pleuropericardial fold shows a superficial laceration, oval, 0.2×0.3 inch, the surrounding pleura a little blood-stained. The mesial surface at a point close to the spinal column, about 1.3 inches behind the aorta and near the ninth intercostal space, shows an oval, lacerated wound, 0.3×0.5 inch, the surrounding pleura a little blood-stained; at a point 0.1 to 0.5 inch behind this is a similar laceration 0.3×0.6 inch.

Right: traversed by old fibrous adhesions at the apex; contains about 200 c.c. of blood-stained fluid.

Pericardial Cavity.—The pericardium opened along its left-hand border by a surgical incised wound running nearly its entire length; the cavity contains 50 c.c. of currant-jelly-like clot; the left-hand wall of the pericardium at a point 0.5 inch from its reflection upon the diaphragm shows the perforating wound above described. *A probe introduced into the wound of the rib above described and passed successively through the wounds of the wall of the left ventricle of the heart, the pericardium, the diaphragm, the left lobe of the liver, the diaphragm, the lower lobe of the left lung, and the inner wall of the left pleural cavity, occupies a position nearly horizontal and at an angle of about thirty degrees with the sagittal plane from the left backwards and inwards.*

The venæ cavæ and pulmonary veins on section yield a small amount of red, post-mortem clot.

Heart.—Weight, 380 Gm.; epicardial fat fairly abundant; the wall of the left ventricle at a point 1.5 inches (3.5 cm.) from the apex shows a ragged, lacerated wound about 0.8 inch (2 cm.) in diameter closed by sutures; the posterior surface of the wall at a distance of 1.8 inches (4.5 cm.) from the apex and 0.6 inch (1.5 cm.) from the left-hand border shows an oval, lacerated wound about 0.8×0.5 inch (1.8×1.2 cm.). Upon section the cavities of both sides contain a very little post-mortem clot; myocardium light brownish red and fairly firm. The wall of the left ventricle at the site of the sutured wound shows extensive laceration penetrating to the cavity of the ventricle; the wound upon the posterior surface is continuous with this laceration through the substance of the myocardium, the wound extending obliquely from before backwards. The trabeculæ of the right ventricle prominent. The endocardium shows some post-mortem blood-staining; the valves and cavities normal. Coronary arteries normal.

Lungs.—Left: apex normal; slaty gray; collapsed; incompressible; flabby; the lower lobe shows the wounds above noted, that near the lower border perforating; in addition to these wounds the upper lobe on its front and lower border shows a small laceration about 0.3 inch across, the surrounding pleura blood-stained; this wound in the natural position of the lung overlies the wounds at the base of the lower lobe. Upon section grayish red, fleshy, under pressure yielding a moderate amount of blood-stained watery fluid; the bronchi empty; the bronchial mucosa dark red.

Right: apex normal, the front grayish red, the back bluish red; fairly

crepitant throughout; the pleura without markings. Upon section dark grayish red and wet, yielding abundant bloody froth.

Abdomen.—Peritoneal cavity (continued); between the left lobe of the liver, the stomach, and about the spleen is a small amount of red clot; the upper surface of the left lobe of the liver at a point 1.3 inches (3.2 cm.) from the middle line and a like distance from its attachment to the diaphragm shows an oval, lacerated wound about 0.2×0.3 (0.50×0.75 cm.) surrounded by a zone of blood-staining; the under surface of this lobe close to its posterior border shows a stellate, lacerated wound, the opened portion of which is 0.5 cm. across, lines of fracture radiating from it; the wound contains a little blood-clot. The peritoneum of the front and upper portion of the stomach (cardia) shows a superficial laceration about 1 inch across, the surrounding peritoneum blood-stained within a region about 4 inches across; continuous with this laceration is a ragged wound of the tissues between the diaphragm, continued into the second of the wounds in the latter above described.

Stomach.—Contains 500 c.c. of brownish, soup-like material without significant odor, in which are fragments of undigested meat; the mucosa of the cardia shows mottled bluish red discoloration, at a point opposite the laceration of the peritoneum above noted presenting a superficial tear about 0.5×0.1 inch (1.25×0.25 cm.); the mucosa in general yellowish gray and lustrous, that of the lesser curvature mottled with small punctate hemorrhages.

Liver.—Weight, 1790 Gm.; light yellowish brown; surface presents a faint "grain leather" appearance; the left lobe in its posterior border shows the wound above described. Upon section of similar color; muddy; consistence somewhat diminished.

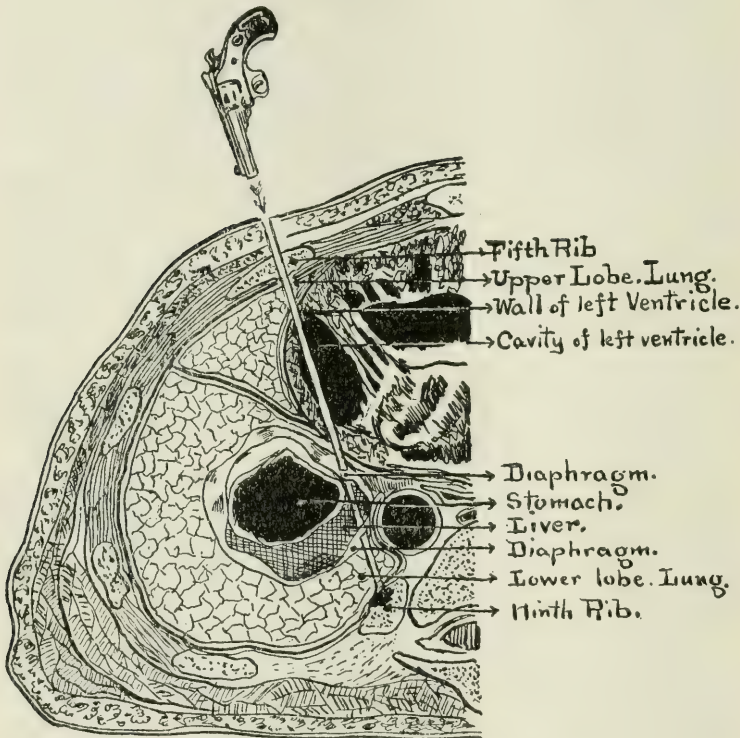
Dissection in the region of the wound on the inner wall of the left pleural cavity shows opposite the intervertebral disk a ragged wound penetrating the upper border of the tenth rib close to its articulation; lying upon the fragmented border of the rib at a point about 1 inch from the median line is a leaden slug 0.7 cm. in diameter, point outward, the base slightly flattened, imbedded in the intercostal muscle.

(NOTE.—From a study of the wounds above described, it appears that the bullet, entering the front wall of the left side of the chest near the nipple line, penetrating the skin, subcutaneous tissues, the fifth rib, the pericardium, passed through the wall of the left ventricle obliquely from before backwards, opening the cavity of the ventricle, passed outward, penetrating the diaphragm, passed through the left lobe of the liver close to its posterior border, again penetrating the diaphragm passed through the lower lobe of the left lung, passed out of the left pleural cavity through a wound in the ninth intercostal space, becoming embedded in the intercostal muscles close to the upper border of the tenth rib, its direction from before backwards towards the middle line at an angle of about 30 degrees with the sagittal plane and in a plane with the horizontal.)

While the technic of the operation was faulty in many respects, we became convinced that the exposure of the cardiac

area is not a difficult surgical procedure, and that the heart possesses a surprising resistance to the trauma of manual and instrumental manipulation. The hemorrhage of the six hours previous to operation and the blood loss resulting from faulty technic and a tearing out of sutures were doubtless the leading factors which contributed to the fatal result.

FIG. 1.



Diagrammatic drawing of cross section of left thorax including the dome of the diaphragm, to show structures traversed by the course of the bullet.

The following discussion of the symptomatology, indications for operation, and treatment of such injuries is based upon the above experience, and upon the study of a large number of cases reported by other writers.

Diagnosis of Heart Wounds.—The existence of a wound in the heart is frequently suspected though not confirmed

except by operation or autopsy. With rare exceptions a definite diagnosis is quite impossible. Heart injuries are so commonly associated with wounds in the lung and pleura, that although the latter may be diagnosed, uncertainty invariably exists as to the heart involvement.

A small proportion of stab and bullet wounds of the chest is confined to the heart, and such cases are most liable to correct diagnosis. Hemorrhage is confined to the pericardium and the anterior mediastinum. As the hemorrhage increases, the pericardial opening sometimes becomes occluded and the condition known as "heart tamponade" arises. As the intrapericardial tension increases and the heart labors against it, a group of symptoms develop which are almost pathognomonic of the condition. Pain in the arm, a sense of constriction of the heart, dyspnoea, profound shock, and cold sweat are characteristic. A whirring sound in the cardiac region occurs infrequently. Several operators have in common discovered a symptom which is not noted by others, namely, absence of radial pulse in the left wrist, accompanied by a weak and scarcely palpable pulse in the right wrist (Fischer, Borzymowski, Tscherniachowski). Luxembourg lays emphasis on the feature that in the presence of heart tamponade the symptoms of air-hunger, dyspnoea, and pain, while distressing in the recumbent position, are relieved by a sitting posture. Auscultation and percussion invariably reveal an enlargement of the heart area, which is further demonstrated by the radiograph. If this enlarged heart shadow is in the line of the point of entrance and exit of a bullet, or coincides with that area towards which the canal of entrance of a stab wound is pointing, further evidence of hæmopericardium is provided.

As this condition of hæmopericardium continues, the right side of the heart is compressed, the blood from the large veins ceases to enter the auricles, the ventricles are soon empty, and the heart, now devoid of blood, ceases to beat.

Although this condition of hæmopericardium may usually be recognized and may even be verified by exploratory puncture (Rehn), pleural complications, such as we have described

in our own case, render the diagnosis of heart injury uncertain. Flatness at the base of the left chest with symptoms of hemorrhage indicate at least hæmothorax. This accumulation of blood may come from the lung or from the pericardium, or from both. In many cases this hæmothorax is also a hæmopneumothorax. If the injured vessels alone provide the hemorrhage, the neighboring air-passages are at the same time opened. A wound in the pleural lateral aspect of the pericardium may result in profuse hemorrhage from the heart into the pleural cavity, but such a wound is impossible without concurrent laceration of that portion of the upper lobe of the lung which approximates the pericardial region. Thus, though the hemorrhage may not be essentially from the lung, a degree of pneumothorax is also produced.

This extensive accumulation of blood in the pleural cavity obscures the left border of the heart dulness and may also displace the heart to the right, so that percussion and radiography may give the same appearance to the right of the sternum as in the presence of hæmopericardium. Dyspnœa, shock, air-hunger, and signs of hemorrhage may all be present from lung injury alone. If the heart is transpleurally injured, hæmopericardium does not exist because of the leakage of blood into the pleural cavity. In such instances, therefore, we are deprived of the characteristic symptoms of pericardial tension, which are the most contributory in the differential diagnosis of heart wound alone.

Indications for Operation.—It is evident from the complexity of symptoms which invariably exists in this group of cases, that a definite diagnosis as to the lesions present is usually impossible. Statistics collected by Luxembourg show that the pleura escaped injury in but five of a series of 65 cases. The chances for recovery from both lung and heart injuries must be weighed, then, in most of the cases.

In the well-known publication of Fischer in 1868, with a study of 452 cases of heart injury, we are told that 15 per cent. resulted in spontaneous cure. The exact extent of the heart injury in these cases is not known, and it is conceivable that

complete wounds in the auricles or ventricles were not present.

We are forcibly reminded of the dangers of expectant treatment when we recall, that while 15 per cent. of cases with presumably slight injury may recover spontaneously, 45 per cent. of the operated cases in 13 years have been cured. In other words, statistics alone indicate that operative interference offers the best hope of recovery.

Expectant treatment may be justified in two groups of cases of stab and bullet wounds of the thorax. First: In rare cases direct heart injury alone may be suspected from the localization and symptoms. Intrapericardial tension from hæmopericardium may develop until a small wound in the heart muscle is occluded by the clot formation in the pericardium before the fatal results of heart tamponade ensue. Careful observation of the patient should disclose whether the hemorrhage is restricted and whether or not the pericardial tension is approaching the dangerous limits disclosed by the symptoms above referred to. Second: A group of cases in which the remoteness of the point of injury, the absence of extreme shock and hemorrhage, the lack of symptoms pointing to intrapericardial tension justify the presumption that the heart is probably not injured and that the lung wound is a small one. From such injuries of the periphery of the lung, with slight hemorrhage and an insignificant amount of pneumothorax, recovery is not uncommon. Such cases should be treated expectantly.

If, on the contrary, the hemorrhage is increasing, or the dangers of tension pneumothorax are imminent, even though the point of entrance excludes the possibility of heart injury, operation is indicated for repair of pulmonary injury, and is, with the use of differential pressure, more justified than six years ago. If the pleura and lung are injured and the heart cannot be excluded, immediate operation should be performed in every case. If the point of injury and other symptoms indicate probable heart injury, with signs either of hemorrhage into the pleural cavity or of increasing intrapericardial hemorrhage, operation should not be delayed.

Two new agents are now at our disposal in the operative

treatment of these grave cases, which should increase our enthusiasm to interfere. We refer to transfusion and the use of differential pressure. With the exception of those few cases in which almost immediate death follows injury to the heart, due perhaps to reflex inhibitory stimulation to the heart or respiratory centres, hemorrhage before and during operation is ordinarily a fatal factor when death occurs within 24 hours. Saline infusions have been administered before and during some of the operations reported, with undoubted stimulative effect. Transfusion introduced at the moment of the completion of the heart suture should be of specific value to restore the blood-pressure and to provide the heart muscle with working material.

Statistics show that 75 per cent. of heart injuries are associated with wounds in the pleura. This insures collapse of the lung at operation, whether by the mediastinal or transpleural route. A sudden pathological condition is at this moment introduced. The lung of the uninjured side must perform the oxygenation normally maintained by both lungs. The amount of blood which reaches this lung is diminished by hemorrhage. Complete inspiration is restricted by the oscillations of the mediastinum to the unopened side, and the complete expiration of CO_2 is prevented by the mediastinal movement in the opposite direction (Garrè and Quincke). The one functioning lung is therefore restricted in its efforts at vicarious compensation. Surgeons have been loath to credit a fatality from operation for heart wound to the effects of pneumothorax, for in the presence of profound hemorrhage and manual and instrumental trauma to the heart muscle the presence of air in the pleural cavity would seem to be of secondary importance and an inadequate excuse for death. It cannot be denied, however, that collapse of the lung alone will cause changes in the pulmonary circulation, and does in certain cases markedly and even fatally restrict the respiratory function of the remaining lung. Whether this factor may, in a given case, be of great or partial significance, the prevention of this dangerous element is certainly of value, and the now established

methods of plus and minus pressure to prevent lung collapse will undoubtedly reduce the mortality in these operations. The added advantages in the use of differential pressure to diminish infection by the re-expansion of the lung at the end of operation, and its employment to facilitate the transpleural approach to the heart, we will again consider under operative treatment.

Technic of Operation.—It is to be regretted that a review of the 177 operations for heart injury which have been recorded discloses no particular technic which one can conclude to be the most desirable. No one method of approach has been conspicuously attended with greater success than another. Few fatalities can be accounted for by the method employed, and the unnecessary expenditure of time apparent in certain cases may have been due to lack of skill rather than to method.

In a large proportion of the reported cases, the extrapleural route was selected regardless of the evident involvement of pleura and lung. For this approach to the heart *via* the anterior mediastinum at least twenty different skin incisions and osteoplastic operations have been recommended. The sternum has been bisected and partially resected. Two, three, and four ribs have been divided and reflected outwards or medianwards, or resected for varying lengths with and without the cartilaginous portions. Flaps of skin, muscle, bone, and pleura have been reflected, with division of the ribs at one edge of the flap and fracture at the hinge. The hinge of such flaps has been made toward the median line and away from it. Incisions have been recommended which start vertically over the sternum and extend laterally in a direction parallel to the underlying ribs. The cartilage of several ribs may be divided and intercostal incisions made above and below the upper and lower divided ribs respectively. The rib-and-intercostal-muscle flap may then be sprung away, exposing a window. Operative rupture of the pleura is admitted in many instances wherein the extrapleural route was attempted.

In determining the preferable method of approach in this

group of cases, we must again bear in mind that heart injury alone is rarely to be considered, and that the pleura and lung are also involved (Tscherniachowski). If confronted with the symptoms of heart tamponade, namely, hæmopericardium, with increasing tension, with absence of signs pointing to intrapleural injury, some method of extrapleural approach through the precordial space is indicated. The skin incision and bone or cartilaginous resection or reflection are determined by the position of the entrance wound and by the direction of the entrance canal. In other words, given a diagnosis of heart injury alone, a *skin* flap may be reflected which will include that part of the heart area designated by the external wounds. The wound canal should then be further explored. If injury to the base of the heart is suspected, resection of portions of the sternum may then be required, together with two, three, or more costal cartilages.

The employment of a skin, muscle, and bone flap is contraindicated for four reasons: (1) Because the size of this flap must be previously determined and a definite area exposed, which may or may not be the most suitable one for the injury at hand. Reflecting the layers of the chest wall one by one, on the other hand, enables one to follow the course of the bullet by degrees, disclosing perhaps that the point of injury in the heart by no means corresponds to the skin wound. (2) The reflection of such flaps favors accidental injury to the pleura as well as to the intercostal and mammary vessels, which cannot be easily picked up until the whole flap is reflected. An unnecessary loss of blood may thus result (Rehn). (3) Infection has been found to be favored by this flap method, presumably causing necrosis of tissue along the edges of the flap, both in the bone and muscle layers. (4) Air-tight suture of an osteoplastic flap is difficult.

Intercostal Incisions.—Wilms, Salomoni, Iselin, Floercken, and Rehn have clearly demonstrated the advisability of an intercostal incision in the anterior part of the fourth or fifth intercostal space, which with separation of the adjoining ribs gives free access to both auricles and ventricles. They advo-

cate the division of one or more ribs above or below the incision as the case may require, and even the removal of a portion of the sternum if the base of the heart is to be reached. The heart, they claim, may thus be exposed and sutured without injury to the pleura. A further advantage of this intercostal incision rests in the fact, that if the pleura is apparently injured, or if pleura and lung injury is discovered in the course of the operation, a lengthening of this incision outwards will, with the use of a rib-spreader, expose both the lung and heart areas.

This lateral intercostal incision for intrathoracic surgery recommended by Mikulicz, and further advocated by Sauerbruch and Tiegel, has within the past six years become recognized by investigators in intrathoracic problems as preferable to the osteoplastic resection in cases where the thorax is to be closed at the end of operation. With the use of a Mikulicz rib-spreader, or even with retraction with the usual retractors, an operative field will be exposed which few operators can appreciate who have not seen it employed. It has the additional advantage of permitting air-tight closure of the intercostal incision at the end of operation by means of a pericostal stitch which approximates the adjacent intercostal muscles. One of us has employed this technic in a series of 40 pulmonary operations on animals, and is convinced of its practicability.

There is reason to believe that the ultimate technic for this group of injuries, involving either the heart or lung or both, will be the employment under differential pressure of a long intercostal incision, with spreading of the ribs and exposure of both the areas in question. The advantages may be stated as follows:

1. Economy of time. With the employment of differential pressure the pleura may be opened wide without hesitation. There is no loss of time and effort to avoid injury to the pleura, which is usually unsuccessfully attempted in the extrapleural methods.

2. All anxiety concerning the possible fatal effects of pneumothorax is obviated.

3. Inflation of the lung discloses the injured areas in the lung by the escape of air, facilitating their localization and repair.

4. Differential pressure by maintaining the expansion of the lungs prevents the sagging of the heart posteriorly upwards and to the left.

5. Both auricles and ventricles are accessible, and the posterior cardiac wall as well as the anterior.

6. The reinflation of the lung at the end of operation, followed by tight closure of the intercostal wound, prevents the persistence of pneumothorax which is generally admitted to favor infection, the usual cause of death in these cases which survive the operation itself.

7. The widely exposed field enables the operator to reach and compress the vessels at the base of the heart and control hemorrhage.

When the heart area has been exposed by one of the above-mentioned methods, although the pleural cavity may contain blood, and bleeding wounds of the lung be discovered, the pericardium should be carefully examined and the possibility of heart wound not abandoned, even in the absence of lacerations of the pericardium. Fourteen cases are now recorded of rupture of the heart muscle in the presence of an intact pericardium. Wilms explains this at first incomprehensible condition by principles of hydrodynamics. It presumably occurs only in cases of bullet injuries. The elasticity of the pericardium may allow the bullet to administer a sudden blow upon the more resistant contracted heart muscle, which produces a rupture rather than a perforation of the ventricular wall. Luxembourg reports a case in which two bullets were found lying in the anterior mediastinum without perforation of the pericardium. Both bullets were removed and the operation abandoned. Death ensued, and autopsy revealed a double heart wound which resulted in hæmopericardium and death. It would seem, therefore, that in all cases of this group of chest injuries the pericardium should be incised if there is

any accumulation of blood within it, lest one of these obscured heart ruptures be overlooked.

It is at the moment of the pericardiotomy that the critical point of these operations sometimes arises. All resistance to heart leakage which the pericardium may have hitherto provided is suddenly removed. Our own case provided ample illustration of this situation. Sometimes the hole in the ventricle may be small and the hemorrhage slight. In some cases the blood loss is immediately terrific. If violent hemorrhage exists, an attempt to check it is of primary importance before attempting the suture. Loss of blood previous to this moment may also have been of great consequence. Our own experience is a reminder of the futility of attempting to introduce a needle without regard to the escape of blood. If the wound is in plain view, the stream spurting from a ventricle strikes the eyes of the operator with surprising accuracy. One stitch when introduced and tied is seldom enough to check the flow. Tension on the first stitch with the hope of checking hemorrhage is likely to result in tearing of the heart muscle. This occurred on two occasions in this case. Tension which may be endured by the muscle at diastole is suddenly increased at systole with resulting tear. The trauma to the heart muscle causes immediate increased rapidity of contraction, and the introduction of sutures under these conditions of violent motion and hemorrhage is quite impossible.

Experimental investigation has been helpful in regard to possible means of checking this profuse hemorrhage. Elsberg reports that the rabbit heart will endure a ligature around its central portion which will prevent hemorrhage from openings near the apex. He has successfully sutured such openings, and the ligatures have been tolerated for some minutes. Few wounds in the human heart are suitable perhaps for this method, and the contribution from the experiments is more in showing the toleration of the heart to such extreme trauma.

Rehn, Haecker, Tigerstedt, Noetzel, Lawen and Siever, and Elsberg have determined the length of time which animals will endure the compression of the great vessels at the base

of the heart. Lawen and Siever conclude that in closure of the vena cava the lung and coronary circulations remain intact for nine minutes in the rabbit, although distinct disturbances from cerebral anæmia are noted in the interim. For three minutes the veins may be compressed without disturbances of either heart or brain. They state further that complications can be lessened if the compression is omitted from time to time, even at the expense of a slight loss of blood. Sauerbruch concludes from experiments that the superior and inferior cavæ may be compressed for 10 minutes, in which time the heart-beat is small and irregular. On removing the compression, the right ventricle becomes suddenly dilated, and the heart-beat momentarily ceases. A more extensive series of experiments by Haecker results in similar conclusions.

We have substantial experimental evidence, then, that manual compression of the veins at least is a safe procedure, if not employed too long or too continuously, and we may say that in our own operation, being already familiar with these experiments, the veins at the base were held for intervals of 15 to 20 seconds, distinctly checking the blood leakage and facilitating the suture. The aorta was undoubtedly partially compressed at the same time, and the effect on the heart-beat was identical with that described by Haecker and Sauerbruch. After each temporary compression of the vessels, the heart seemed less able to recover its original rate of contraction; in fact, complete cessation and death occurred after the completion of the suture to the pericardium, within three minutes of the last compression. We are by no means prepared to state that the compression was the cause of the death in this case. The hemorrhage before operation had been profuse, and even greater during the operation, this factor alone being an adequate cause of death. We regret that the compression was not employed immediately after the pericardium was opened, instead of after attempt at suture without effort to check hemorrhage had failed.

Looking further for means of hæmostasis during heart suture, in these cases in which hemorrhage is profuse, we find

possibilities in the use of differential pressure. Sauerbruch, in experimental suture of artificial heart wounds with the use of negative pressure, has noted that allowing the lung to collapse within safe limits has resulted in a slowing of the heart-beat and a concurrent diminution in the hemorrhage from the heart wound. He explains this phenomenon on the basis that the collapsed lung retains more blood than is normal to it, and that resultingly less blood for the time being enters the heart. The slowing of the heart-beat, together with slight dyspnœa, is a well-known symptom of the effects of pneumothorax and lung collapse, and many observers have been impressed with the control of the pulse-rate by raising or lowering the differential pressure.

This application of the "Sauerbruch idea" to heart surgery would seem to argue that the heart-rate and the amount of hemorrhage would be most satisfactory without the use of any differential pressure. As we have stated above, however, we believe that deaths during the heart suture, which have been ascribed to the hemorrhage and operation, have often resulted more especially from the effects of pneumothorax. For the prevention of this, differential pressure is necessary. Its temporary omission or reduction to the amount of 3 mm. of mercury is sufficient to provide the benefits to which we have referred, without permitting the possible fatal effects of pneumothorax.

As regards the technic of the suture itself, little preference can be concluded from our own experience, or from that of others. Death has seldom occurred from subsequent leakage if the suture is once established; in fact one might even conclude that the kind of material is of comparatively little significance. Round needles and interrupted sutures, not including the endocardium, are probably to be preferred.

Drainage.—Of 112 cases of stab and bullet wounds of the heart which survived the operation itself, 67 (60 per cent.) had infections of the pericardium or pleura or both. Forty-one of these died and 26 recovered (Peck). A study of the individual infected cases shows that infection occurred a trifle

more frequently with drainage than without. Rehn and Vaughan accept these statistics as evidence that drainage is not advisable except in cases where hæmostasis has not been complete.

We believe that drainage of the pleural cavity should not be established at the end of operation for two reasons:

First: If a virulent infection has been introduced at the time of injury or operation, the introduction of a drain to the pleural cavity will be insufficient to check the progress of an acute septicæmia. If, on the other hand, the infection is less virulent and confined to the pleura, there is probably no danger in waiting until the symptoms of empyema develop. Adhesions, too, may have occurred in the interim which will tend to localize the septic process. Drainage may then be established with a suction method, which will dispose of the infectious material without permitting complete lung collapse.

Second: It is a well-recognized fact that the presence of pneumothorax favors infection after operation. The presence of drainage at once establishes this unfavorable condition.

In this connection it should be remembered that a closed pneumothorax also favors infection; that is to say, the air-tight closure of the thoracotomy wound without previous re-inflation of the lung. It is quite as important, therefore, to obliterate the pleural space before closure as it is to omit drainage. If this feature is neglected and the lung is left in the collapsed state, atmospheric pressure persists in one pleural cavity while the normal negative pressure remains in the unopened side of the thorax. The resulting inequality in the pressure of the two sides of the chest prevents the re-expansion of the collapsed lung, and often causes a pleuritic transudate which serves as an admirable culture medium. To prevent this, normal negative pressure in the operated side should be restored, either by artificial inflation just before the tying of the last wall suture, or by aspiration after the closure of the wound. If differential pressure is at hand, the former means is employed without difficulty.

The resistance of the patient, not only to infection but to

the blood loss and shock, is undoubtedly increased by the restored function of the collapsed lung. The balance between the pulmonary and aortic circulation is restored to normal, and the oxygenating surface is not reduced at this time of need.

Concerning drainage of the pericardium, the consensus of opinion is in favor of closure with subsequent aspiration if pericarditis ensues.

Statistics.—The most recent accumulation of stab and bullet wounds of the heart is that of Grisogono, who adds to the statistics of Salomoni and Peck eight additional cases, making a total of 172 with 69 recoveries. In addition to these the following cases have been collected from the literature of 1910:

1. GUINARD (*Bull. et mém. Société de Chir.*, Paris, 1910, n.s., xxxvi, 162): one case of bullet wound, death.

2. FOEDERL (*Wiener klin. Wochenschrift*, 1910, xxiii, No. 25): one case of bullet wound, recovery.

3 and 4. RASSIEUR (*Journal Missouri Med. Assoc.*, St. Louis, 1909-10, vi, pp. 316-320): one case of bullet wound, recovery; one case of stab wound, death.

5. BREWSTER and ROBINSON: one case of bullet wound, death.

It was a surprise to find that of a total of some 177 heart injuries only 24 were produced by bullets. The feature which is noticeable in the following table of bullet wounds is the comparative frequency of wounds of both walls of the ventricles, while in stab wounds a single wound is the rule. The percentage of mortality is not unlike that of heart wounds in general. From the number of stab wounds which have been reported one might conclude that bullet wounds are more often immediately fatal. A large proportion of the stab wounds are reported from parts of Europe where knife wounds are of more common occurrence.

CONCLUSIONS.

1. The diagnosis of heart injury is usually difficult.
2. Heart wounds rarely exist without pleural or lung involvement.
3. Operative rather than expectant treatment is indicated in a large proportion of the cases.

TABLE OF SUTURED BULLET WOUNDS OF THE HEART TO DECEMBER, 1910.

No.	Operator and year.	Time elapsed before operation.	Location of bullet wound.	Method of exposing heart.	Cavity wounded and treatment.	Drainage of—		Complications.	Result.
						Pericardium.	Pleura.		
1	Bardenheuer, 1904	.....	.....	.....	Heart perforated; entrance and exit wounds sutured L. v.; sutured.....	.....	.....	Pericarditis and pleuritis	Death 2 days later.
2	Bardenheuer, 1904	.....	.....	Sutured.....	.....	.....	.....	Pericarditis; septic pleuritis	Death 10 days later.
3	Bougle, 1901.	1 hour..	Bullet in 3d left space; a finger's breadth from sternum	Flap of 3d, 4th, and 5th cartilages; hinge external	Right ventricle; 2 holes both sutured with catgut	No....	Yes...	Bullet passed through wall of ventricle, not opening cavity	Death 5 hours later.
4	Brezard and Morel, 1905.	Soon....	Bullet (8 mm.) in 3d left space, 2 cm. from sternum	Flap of 3d, 4th, and 5th ribs; hinge external	Left ventricle; 2 wounds, entrance and exit, sutured with catgut	No....	.....	Cavity of ventricle not opened	Died on table; hemorrhage.
5	Bufnoir, 1899	.....	Gunshot wound in 5th left space; 22 calib.	.....	Right ventricle; 1 opening sutured	.....	.....	Ventricle perforated; exit wound not sutured	Died.
6	Fittig, 1908..	2 hours.	Pistol-shot wound in 3d left space, internal to nipple	Intercostal incision in 4th space; resection of 4th and 5th ribs	Left ventricle; 2 wounds, anterior and posterior 3 cm. and 1 cm., 6 catgut sutures in anterior wound	Yes...	Yes...	.....	Died 24 hours later; anæmia.
7	Goebell, 1905.	1 hour..	Pistol ball, 7 mm..	Flap of ribs; hinge external	Left ventricle; entrance and exit, both sutured with catgut	Yes...	Yes...	None.....	Recovered.
8	Launay, 1902	4 hours.	Pistol ball, 7 mm. in left nipple	Flap of 4th, 5th and 6th ribs; hinge external	Left ventricle; perforated, entrance and exit closed with catgut sutures	Yes...	Yes...	.....	Recovered.
9	Lenormant, 1905	7 hours.	Pistol ball in 5th left space at sternal border	Flap of 4th, 5th and 6th ribs; hinge external	Right ventricle; 15 mm. 3 silk sutures; liver, stomach, and bowels wounded	Yes...	.....	Syncope on table; traction on tongue and heart massage revived him	Died 4½ hours later.

10	Manteuffel, 1903	9 hours.	Pistol ball, 5 mm. in 4th left space	Resection of 4th, 5th 6th, and 7th carti- lages	Right ventricle; went through anterior wall and lodged in posterior, where it could be felt. In- cision and removal. Silk sutures closed both wounds	No....	Yes...	Pericarditis; aspi- rated	Recovered.
11	Marion, 1898.	2 hours.	Pistol ball, 4th left space, 3 cm. from sternum	Resection of 6th and 7th cartilages and part of sternum	Right ventricle, per- forated, anterior wound sutured	.....	.....	Ball did not open pericardium	Died on table.
12	Moresstin, 1903	21 hours	Pistol ball, 8 mm. in sternum, opposite 4th cartilage	Cut through ster- num	Right ventricle; 1 opening; 4 catgut sutures	Yes...	Yes...	Ball found in cav- ity of right ven- tricle	Died 19 hours later, from embolism(?)
13	Noll, 1903.....	1½ hours	Pistol ball, 8 mm. in 1st left space	.....	Left ventricle; wound sutured	Yes...	Yes...	Pleurisy	Recovered.
14	Riche, 1904..	1½ hours	Pistol ball, 8 mm. in 5th left space, within and below nipple	Flap of 3d, 4th, and 5th ribs; hinge ex- ternal	Left ventricle; 2 wounds; catgut su- tures in both	.....	.....	.....	Died on table.
15	Rimann, 1909	1½ hours	Gunshot wound per- forating 3d rib	Resection of 4th and 5th cartilages	Left ventricle; 5 silk sutures	No....	No....	Serous pleuritis; aspiration 12 days after opera- tion	Recovered.
16	Rothfuchs, 1905	.....	Bullet	Resection of 4th and 5th ribs	Left ventricle; per- forated; catgut su- ture in both wounds	.....	Yes...	Ball went through stomach and lodged in dia- phragm	Died 24 hours later; peritonitis.
17	Schubert, 1904	½ hour..	Bullet in 4th left space	Resection of 4th rib	2 wounds in heart, 1 anterior, 1 poste- rior, both sutured with catgut	.....	.....	Operator thought bullet passed through inter- ventricular sep- tum without opening a ven- tricle	Recovered.
18	Sultan, G., 1907	30 hours	Pistol ball, 9 mm. in 5th left space in- side nipple line	Flap of sternum and left 4th and 5th cartilages; hinge on right	Left ventricle; cav- ity not opened; 3 silk sutures	.....	(1)	None.....	Recovered.
19	Vidal, 1908..	1½ hours	Bullet wound in 4th space, 10 cm. from median line	Incision in 3d left space without re- secting ribs, under positive pressure. Pleura freely opened	Left ventricle; 2 su- tures	No....	No....	.....	Recovered.
20	Wilms, 1906..	2 hours	Pistol ball, 6 mm....	Intercostal incision opened	Left ventricle per- forated; both su- tured	No....	No....	None.....	Recovered.

1 Not opened.

TABLE OF SUTURED BULLET WOUNDS OF THE HEART TO DECEMBER, 1910.—Continued.

No.	Operator and year.	Time elapsed before operation.	Location of bullet wound.	Method of exposing heart.	Cavity wounded and treatment.	Drainage of—		Complications.	Result.
						Pericardium.	Pleura.		
21	Rassieur, 1909	.....	Gunshot wound 4th left space just below and internal to left nipple	Resection of 4th and 5th ribs	Left ventricle; 3 silk sutures; pericardium closed	No....	No....	Empyema.....	Recovered.
22	Foederl, 1909	.....	Gunshot wound in 5th left space 2 fingers below and internal to mammary line	Flap of 4th, 5th, and 6th ribs; hinge inwards	Left ventricle; injury in pericardium and pleura, both closed	.....	.....	Pneumothorax overcome with positive pressure with oxygen mask apparatus	Recovered.
23	Guinard, 1909	20 minutes	Revolver shot 3d interspace 1 cm. internal to mammary line	.....	Left ventricle; 2 holes in pericardium; left wall both had crossed base of heart; 3 catgut sutures to each	No....	No....	Empysema.....	Death 3 hours later.
24	Brewster and Robinson, 1909	6 hours	Bullet wound penetrating 5th left rib near nipple line	Quadrilateral incision; division of cartilages, 3d, 4th and 5th ribs, with double intercostal incision	Left ventricle; sutured with catgut	No....	No....	.....	Death at closure of pericardium.

4. Osteoplastic flaps should not be employed.
5. Intercostal incision, with or without subsequent division of ribs, is the preferable method of approach.
6. In certain cases the heart wound may be of sufficient size to permit violent hemorrhage at the time of suture. In such cases interrupted manual compression of the superior and inferior cavæ may be a possible safe procedure; the profuse hemorrhage without this compression is of greater danger.
7. Differential pressure with apparatus is by no means a *sine qua non* in all operations for wounds of the heart and lungs. It is, however, a valuable agent to control the respiratory function, to regulate the heart-beat, and to reinflate the lung at the end of operation.
8. Air-tight closure of the pleural cavity with reinflation of the lung should be employed when possible; the intercostal incision followed by a pericostal stitch is a successful method of securing tight closure.
9. Drainage of the pericardium is unnecessary.

BIBLIOGRAPHY OF BULLET WOUNDS.

- ¹ Bardenheuer: Münch. med. Wochen., 1904, No. 34, 1534; Allgemeines. Aerztl. Verein zu Köln, July 4, 1904.
- ² Bougle: Bull. de la Soc. Anat. de Paris, 1901, lxxvi, 122.
- ³ Brezard et Morel: Bull. de la Soc. Anat. de Paris, 1905, lxxx, 835.
- ⁴ Bufnoir: Bull. et Mém. Soc. Anat. de Paris, 1899, lxxiv, 65.
- ⁵ Fittig: Beiträge zur klin. Chir., Tuebingen, 1907, lx, 567.
- ⁶ Foederl: Wiener klin. Wochen., 1910, xxiii, No. 25.
- ⁷ Goebell: Verhand. der deutsch. Gesellsch. f. Chir., 1906, xxxv, ii, 70.
- ⁸ Guinard: Bull. et Mém. Soc. de Chir. de Paris, 1910, n.s., xxxvi, 162.
- ⁹ Launay: Bull. acad. de méd. de Paris, 1902, xlviii, 185.
- ¹⁰ Lenormant: Bull. et Mém. Soc. de Chir. de Paris, 1906, xxxii, 681; Gazette des Hôpitaux, 1906, lxxix, 1239.
- ¹¹ Manteuffel: Centralblatt f. Chir., 1905, xxxii, 1096.
- ¹² Marion: La presse Méd., 1899, vii, 148.
- ¹³ Morestin: Archiv. gén. de Méd., 1903, ii, 2380.
- ¹⁴ Noll: Verhandl. deutsch. Gesellsch. f. Chir., 1903, xxxii, 168.
- ¹⁵ Rassiour: Jour. Missouri Med. Assoc., St. Louis, 1909-10, vi, 316.
- ¹⁶ Riche: Bull. Soc. Anat. de Paris, 1904, lxxix, 370; Bull. et Mém. Soc. de Chir. de Paris, 1905, xxxi, 172.
- ¹⁷ Rimann: Münch. med. Wochen., April 13, 1909.
- ¹⁸ Rothfuchs: Deutsch. Zeit. f. Chir., lxxvii, 603.
- ¹⁹ Schubert: Deutsch. Zeit. f. Chir., 1904, lxxv, 71.

- ²⁰ Sultan, G.: *Deutsch. med. Wochen.*, 1908, xxxiv, 277.
²¹ Vidal: *Vingt-et-unième Congr. de Chir. de Paris*, 1908, 637.
²² Wilms: *Centralblatt f. Chir.*, Leipzig, 1906, xxxiii, 817.

OTHER IMPORTANT REFERENCES.

- ¹ Bland-Sutton: *Brit. Med. Jour.*, May 28, 1910.
² Borchardt: *Sammlung. klin. Vortrage*, Leipzig, 1906, N. f. Chir., 102 to 127, p. 297. (Nos. 411, 412, Chir., 113, 114.)
³ Borzymowski: *Medycyna.*, Warsaw, 1904, xxxii, 506, 622.
⁴ Elsberg: *Jour. Exp. Med.*, N. Y., 1899, lv, 479.
⁵ Fischer, A.: *Beit. z. klin. Chir.*, Tuebingen, Sept., 1910, lxix, No. 3.
⁶ Fischer, Georg: *Langenbeck's Archiv. f. klin. Chir.*, Bd. ix, Hft. 3.
⁷ Floercken, H.: *Münch. med. Wochen.*, 1909, lvi, 1634-1637.
⁸ Grisogono, A.: *Wiener klin. Wochen.*, 1910, xxiii, No. 25, pp. 924-926.
⁹ Haecker, R.: *Arch. f. klin. Chir.*, Berlin, 1907, lxxxiv, 1035-1098.
¹⁰ Hasbrouck, E. M.: *Virginia Med. Semi-Month.*, Richmond, Aug. 12, 1910.
¹¹ Hill: *Med. Rec.*, N. Y., Dec. 15, 1900, vol. lviii, No. 24, pp. 921-924.
¹² Iselin: *Deut. Zeit. f. Chir.*, Leipzig, July, 1910, cv, Nos. 5-6.
¹³ Kirchner, W. C. G.: *ANNALS OF SURGERY*, Phila., July, 1910.
¹⁴ Lāwen and Sievers: *Deutsch. Zeit. f. Chir.*, 94, Bd. 5 u. 6, Heft. p. 580.
¹⁵ Luxembourg: *Deut. Zeit. f. Chir.*, 1910, 104, pp. 254-276.
¹⁶ Magenau, F.: *Beitr. z. klin. Chir.*, Tuebingen, Sept., 1910, lxix, No. 3.
¹⁷ Muller and Tavernier: *Lyon Chir.*, 1909-10, ii, 191-198.
¹⁸ Peck, C. H.: *Trans. of the Am. Surg. Assoc.*, 1909, vol. xxvii, pp. 162-198.
¹⁹ Rehn: *Med. Press and Circ.*, London, 1908, n.s., lxxxv, 90-92; *Arch. f. klin. Chir.*, vol. lxxxiii, No. 3, pp. 723-778.
²⁰ Salomoni: *Archives Gén. de Chir.*, Sept., 1909, pp. 881-891.
²¹ Sauerbruch: *Arch. f. klin. Chir.*, vol. lxxxiii, No. 2.
²² Schnitzler, J.: *Wien. med. Wochen.*, 1910, lx, 385-389.
²³ Tscherniachowski: *Deut. Zeit. f. Chir.*, 83, 1906, xii, pp. 288-316.
²⁴ Vaughan: *Jour. American Med. Assoc.*, 1909, vol. lii, No. 6, pp. 429-439.
²⁵ Wendel: *Arch. f. klin. Chir.*, 1906, 80, xi, pp. 215-243.

THE IMPORTANCE OF PRESERVING THE GALL-BLADDER IN OPERATIONS UPON THE GALL-PASSAGES.*

BY JOHN WESLEY LONG, M.D.,

OF GREENSBORO, N. C.

THE object of this paper is to emphasize the importance of retaining the gall-bladder whenever it is possible to do so.

In the upper part of the abdomen the gall-bladder is the surgical landmark. From this innocent-looking side-pocket we must take our bearings always. In making the diagnosis, it matters not whether the lesion be ultimately found in the duodenum, stomach, liver, pancreas, or elsewhere in the neighborhood, our perspective of the situation is neither clear nor comprehensive if we fail to include the gall-bladder in the field of vision, and in differentiating, convict or exclude it from complicity in the morbid process.

Just in the proportion that we give the gall-bladder the first consideration will its importance manifest itself. The more one operates the more he realizes the pre-eminence of this organ in its relation to its correlated group.

When we remember that more than ten times as many operations are done on the gall-bladder as on all the other organs in this region combined, the foregoing assertion can scarcely be questioned.

Following the first cholecystectomy by Langenbuch in 1882, and observing the oftentimes brilliant results obtained, surgeons were quick to adopt the method of extirpation in preference to drainage. Not only cases with positive indications were subjected to cholecystectomy, but those on the border-line and in many instances cases that we know to-day would have done quite as well or better with a cholecystostomy. In the pres-

* Read before the Southern Surgical and Gynæcological Association, December 13, 1910.

ence of the stones and their infected container, surgeons seemed to lose sight of the function and therapeutic value of the gall-bladder. I confess that formerly I taught that cholecystectomy was ideal, therefore the operation of choice, getting rid at once of an infected, obstructed organ, as well as the irritating stones. A critical analysis of 86 operated cases, 20 of them done this year, has led me to think differently, so that my present custom is to never remove the gall-bladder unless the conditions present appear to make it imperative.

The circumstances under which a cholecystostomy would better conserve the interests of the patient may be best understood by first discussing briefly the indications for cholecystectomy.

In the presence of a new growth, particularly primary carcinoma not yet advanced too far, no one would think of anything else than extirpation. In the abundance of precaution it is also a wise practice when doing cholecystostomy to snip out a piece of the gall-bladder for the microscope for fear an unsuspected carcinoma may be present.

If the whole thickness of the bladder walls be gangrenous, there is no other course to pursue than to remove it. However, on several occasions I have been able to preserve the gall-bladder where the mucosa was frankly gangrenous with the muscularis and serosa in the earlier stages of the same process, by doing cholecystostomy; the mucosa sloughing away and restoration taking place in the other layers.

An enormously dilated gall-bladder, when infected and ulcerated, especially if dislocated, should be extirpated. I have one such bladder half as large as the stomach in my collection. Perhaps the degree of infection, the ulcers, and position rather than the size determined me in this instance.

Empyema of the gall-bladder is a relative indication for cholecystectomy. Here again the intensity of the infection, not forgetting the involvement of other organs, must help to decide the question.

The presence of the empyema presupposes closure of the cystic duct. Formerly I felt that if there were no bile in the

gall-bladder the obstruction of the cystic duct was complete and hopeless, but I have come to realize that removal of the stones and septic fluid with drainage will, as a rule, restore the patency of the duct. On adopting cholecystostomy in preference to cholecystectomy in this class of cases, I was at first disturbed because the bile did not begin to flow at once or within a few hours. As experience accumulated, however, I noticed that the discharge of bile was established only after a varying interval, often from three to seven days, in one case on the fifteenth day. It would seem that the closure of the duct is due not only to the presence of the stones but to swelling of the duct mucosa, just as the hypertrophied mucosa of the turbinates closes the nostrils. It should be set down as a rule that in most instances the atresia of the cystic duct is apparent rather than real. Surgeons have been slow to recognize this fact, which once admitted removes empyema from the list of positive indications for cholecystectomy.

It must be rare indeed that a stone impacted in the cystic duct justifies extirpation of the bladder. I have never failed to dislodge the stone except it be in a case like the following, in which years before the gall-bladder had emptied itself into the stomach and the cystic duct and bladder were reduced to an impervious cord, literally crushing the imprisoned stones into the tissues. Drainage had to be made direct from the common duct, which, with the hepatic duct and its various branches, was filled with soft putty-like stones. Lesser grades of tissue destruction from stone impaction do not call for extirpation of the bladder.

Wounds of the gall-bladder are usually considered an indication for ablation. However, unless the trauma is very destructive it is better to drain, for two reasons: first, because drainage preserves the gall-bladder; and second, the fear of normal bile which may escape into the abdomen, producing peritonitis, is unfounded.

Even perforation from ulceration should not be considered an absolute indication for cholecystectomy. Only recently I drained a bladder that was perforated and most of the fifty

stones had escaped into the liver. The patient had been having rigors and high fever. Prompt recovery followed.

In another instance three square stones one-half inch on each facet had ulcerated their way through the side of the gall-bladder and into the common duct. Drainage of the common duct and the gall-bladder brought about perfect recovery. Five years later I opened the abdomen of this same patient to remove the appendix and was astonished to see how nearly normal the gall-bladder and ducts were. In fact there was no occasion for questioning their function.

There are perhaps other indications for cholecystectomy but these are the most common.

The Value of Drainage—the Essence of Cholecystostomy.—Drainage is second in importance only to removal of the stones, in fact more so under some circumstances. For instance, removing stones cannot cure a pancreatitis, drainage does. There is no organ in the body, not excepting the Fallopian tubes, that being once badly damaged responds more effectually to drainage than does the gall-bladder. Attention has already been called to the fact that acute infection, empyema, gangrene, obstructed cystic duct, and even perforation may be overcome by drainage. Moynihan¹ says: "One point cannot be too frequently or too strenuously emphasized, that is, that drainage is the secret of success in gall-bladder surgery."

But over and above the value of drainage to the bladder itself, drainage is the *sine qua non* for curing the patient of the wide-spread sequelæ of the gall-bladder infection. This is best done through and around the gall-bladder. True, the liver and pancreas may be drained through a tube in the common duct, but never so safely, and certainly only for the time being. So important is drainage that when it becomes necessary to do cholecystectomy it is a safe precaution to leave the forceps instead of a ligature on the cystic duct, in order to be able to open the duct and allow a free flow of bile should untoward symptoms develop.

"If there were no other reason for retaining the gall-bladder

¹ Gallstones and Their Surgical Treatment, Moynihan, p. 354.

whenever possible, its intimate anatomical and physiological relations to the pancreas would be sufficient justification. Embryologically it was probably a wise provision to develop so necessary an organ as the pancreas, like the uterus, from two separate points—one bud arising from the posterior wall of the primal tube and the other from the anterior wall in connection with the gall-bladder outgrowth. At first the posterior bud is the more vigorous, developing a large duct (Santorini), but soon the anterior bud forges ahead and fuses with its twin, becoming the main portion with its larger duct (Wirsung). As the gall-bladder and pancreas develop and recede from each other, only their ducts remain united, but in such manner that the function of each organ is in a sense blended with that of the other. Surely such relations mean something.

The gall-bladder has long since ceased to be regarded merely as a storage pouch for bile. The disparity between its capacity and the amount of bile secreted daily is proof of this. Rather should it be considered the *expansion tank* for the bile-duct system. It has been frequently observed in cases where the gall-bladder had long since been destroyed, also following removal of the gall-bladder, that there was a marked dilatation of the common and hepatic ducts, even the little nub remaining of the cystic duct dilating, the dilatation compensating, as it were, for the loss of their expansion tank.

Experimental physiology has demonstrated curiously enough that pure bile injected into the pancreatic duct will cause fatal pancreatitis (Opie, Washington University *et al.*); while mucus from the gall-bladder mixed with the bile greatly modifies its toxicity (Flexner), a cogent reason, it seems to me, for preserving this function of the gall-bladder.

It is interesting to note in this connection how often pancreatitis occurs when the function of the gall-bladder is held in abeyance by disease. We are all familiar with this picture. Under date of December 2, 1910, W. J. Mayo writes: "We have made 3870 operations on the biliary tract, and 7 per cent. of the total had pancreatitis, and 24 per cent. out of 469 operations on the common duct had pancreatitis." This large per-

centage of pancreatitis complicating diseases of the bile-duct system is perhaps the strongest reason that could be advanced for preserving the gall-bladder. What other means have we of dealing with a chronic inflammation of the pancreas? and how truly wonderful are the results! I would like to ask how many surgeons present, after feeling of an enlarged, nodular pancreas marked the case "doubtful," and were surprised to see a perfect recovery ensue under the beneficent influence of drainage. Only a little while ago I drained a perfectly normal bladder because the patient had chronic pancreatitis, with the most satisfactory results.

Drainage is not only essential for the pancreatitis already present, but who knows when a healthy pancreas may become diseased, therefore it is pertinent to retain this avenue of approach. Mayo says, "I quite agree with you that the gall-bladder should be saved wherever possible."

I might add that there are other occasional conditions, such as irremovable obstruction at the duodenal end of the common duct, or indeed, any condition which would justify the operation of cholecystenterostomy—all of which are additional reasons for preserving the gall-bladder.

RETROPERITONEAL AND MESENTERIC CYSTS OF A SIMPLE NATURE.

BY GEORGE HENRY MAKINS, C.B., F.R.C.S.,

OF LONDON,

Surgeon to St. Thomas's Hospital.

THE recent presence in my wards of two simple retroperitoneal cysts affords an opportunity for a short review of the nature, the clinical characters, and the resulting symptoms of such cysts.

CASE I.—The first case was one of the so-called retroperitoneal variety. H. W., aged thirty, a professional athlete and a strong muscular man, had enjoyed perfect health until the time at which he came under observation. Six weeks previously he had sustained a kick in the right hypochondriac region, which gave rise to only moderate pain and did not prevent his playing the game of football out, and since that date he had been playing football regularly. The patient himself was the first to notice a swelling beneath the upper part of the right rectus muscle, and when examined later by Dr. Macewen a subhepatic tumor was palpable.

On examination the prominence of the right rectus muscle was obvious, and on palpation a tumor giving the sensation of a smooth, elastic, tense cyst, moving freely with respiration, and giving a dull note on percussion, was readily felt.

The only symptoms complained of were those of gastric flatulence, and these had been steadily increasing during the past three weeks. Examination of the urine revealed the presence of a trace of bile. The size and position of the cyst, and the latency as far as symptoms were concerned suggested a subhepatic hydatid, but apart from the presence of the tumor no enlargement or displacement of the liver could be detected.

An exploration having been decided upon, a supraumbilical incision carried into the abdominal cavity by separation of the fibres of the rectus muscle was made. The cyst at once presented, covered by the peritoneum of the posterior abdominal

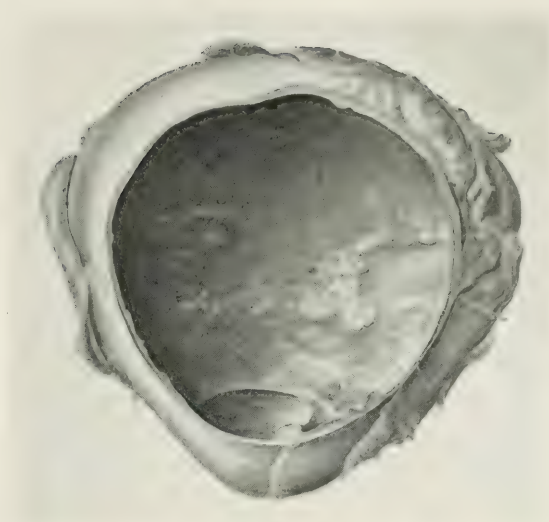
wall and the upper layer of the transverse mesocolon. The descending portion of the duodenum and also a portion of the first part were spread out on the anterior surface of the cyst, which also insinuated itself to some extent between the layers of the gastrohepatic omentum. The gall-bladder lay in direct contact with the right aspect of the cyst. A vertical incision through the peritoneum was made over the most prominent portion of the tumor, its tension was decreased by partial evacuation of the contents by a trocar and canula, and the cyst was stripped out of its bed, mainly by the aid of "gauze dissection." The separation was not very easy in consequence of some inflammatory infiltration of the subperitoneal areolar tissue. The duodenum was first stripped off, and then a connection of some four to five inches in length with the inferior vena cava was separated. The portal vein and bile-ducts lay behind the cyst. When the removal had been completed the gap in the posterior peritoneum was repaired by suture, and the abdomen was closed in the ordinary manner. The patient made a rapid and uneventful recovery from the operation.

The cyst was thick walled and practically unilocular, although the interior exhibited some shallow septa, indicating an originally multilocular character (Fig. 1). Microscopically it was composed of dense connective tissue, and no endothelial lining could be demonstrated. The contained fluid was milky in appearance, suggesting chyle. Microscopical examination, however, demonstrated the absence of any fat globules, and this observation was confirmed by chemical examination, the milky turbidity being due to the presence of a colloid substance precipitable by alcohol. No sugar was present. Some amorphous bodies were seen with the microscope but no cellular elements.

CASE II.—For permission to use the second case I am indebted to my colleague, Mr. Percy W. G. Sargent.

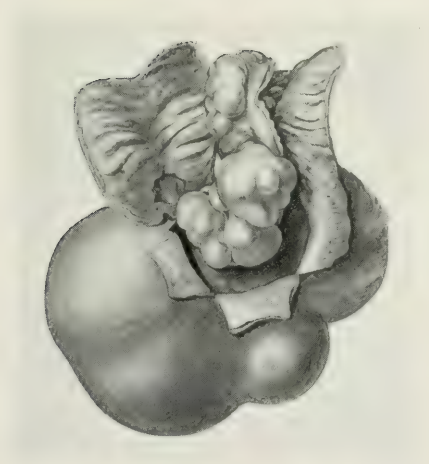
C. J. S., aged forty-eight, a carpenter. Except for a history of the occasional passage of small quantities of bright blood per anum, the patient had enjoyed good health until eighteen days before his admission to the hospital. On that day he slipped and fell on his back. Although no immediate ill-effect was experienced, the fall was followed after four days by a dull pain localized in the region of the umbilicus. This pain gradually increased in severity, and during the last six days of his illness

FIG. 1.



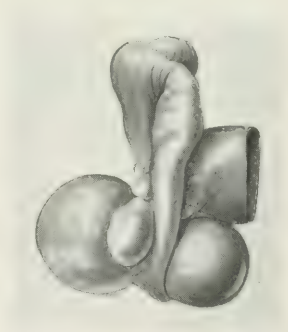
Retromesenteric subhepatic cyst. Note septum indicating original multilocular character (Case I).

FIG. 2.

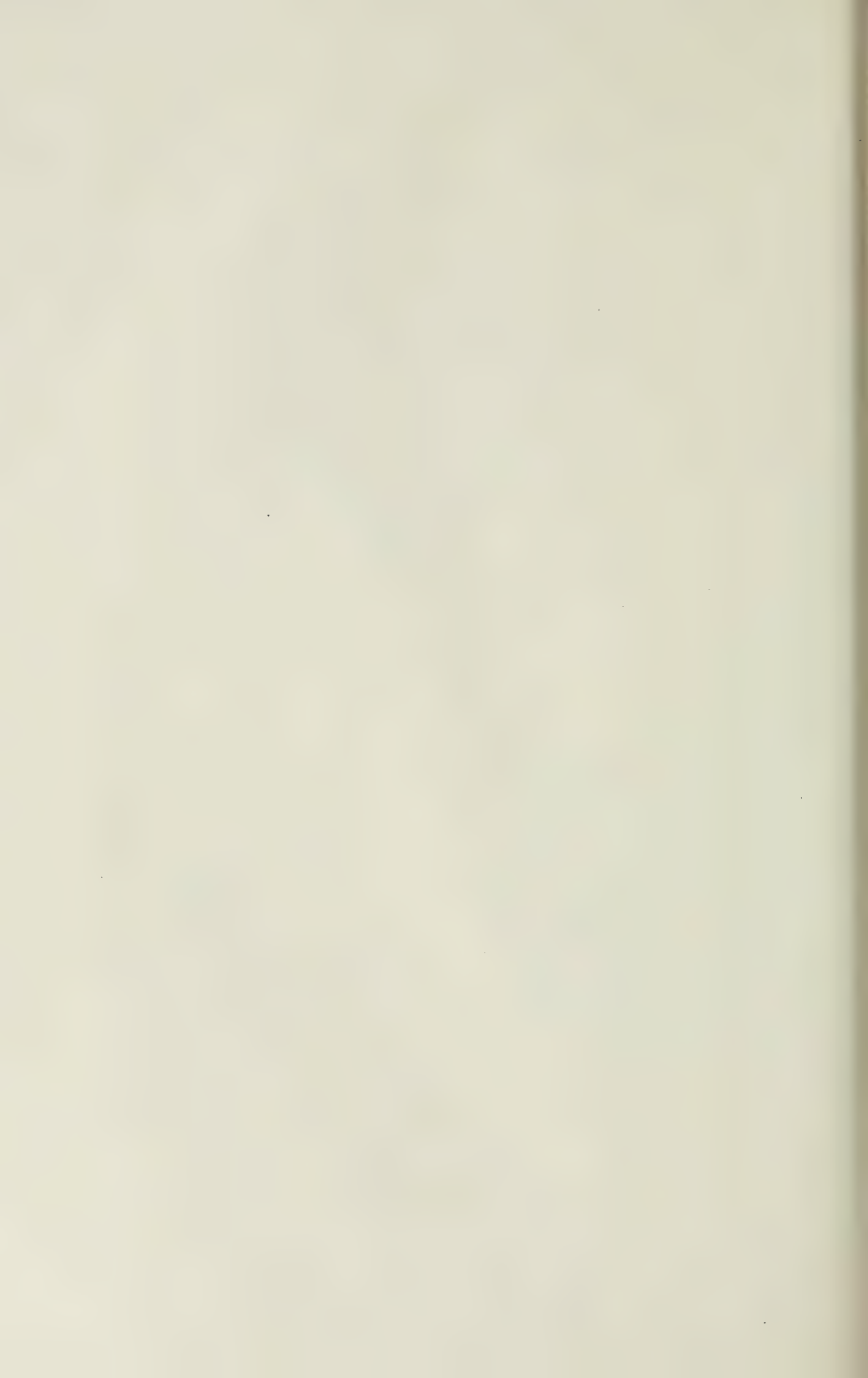


Multilocular mesenteric cyst. Note projection of smaller cysts into the lumen of the bowel (Case III).

FIG. 3.



Multilocular mesenteric cyst. Note situation of intestine in the hollow between two prominent cysts.



was acute, the maximum point of both pain and tenderness lying just to the left of the umbilicus. The pain bore no relation to the ingestion of food, and was unaccompanied by nausea or sickness. The bowels were constipated until a dose of castor-oil had been taken. The patient himself noticed no enlargement in the abdomen until his attention was called to it after his admission into the hospital.

On inspection of the abdomen a local prominence was apparent in the umbilical region, and on palpation this prominence corresponded with a tumor of definite outline occupying the umbilical and extending into the left lumbar region. There was marked intestinal distention, with uneven prominence to the left and below the level of the umbilicus. The surface of the tumor itself was smooth, it was tender on palpation, dull on percussion, and a distinct fluid thrill could be elicited in it. There was no evidence of free fluid in the peritoneal cavity, but the feet and legs were œdematous. The urine had a specific gravity of 1026, and apart from the presence of an excess of urates was normal.

The patient was suffering greatly from pain, and an immediate exploration was performed by Mr. Sargent. A right paramedian incision exposed a large tumor, which after enlargement of the opening was delivered onto the surface of the abdomen, and its retroperitoneal situation determined. The peritoneum of the posterior abdominal wall was incised over the tumor and the latter dissected out, a proceeding accompanied by a considerable amount of hemorrhage. The difficulty in controlling the considerable parenchymatous bleeding suggested the inadvisability of closing the gap in the posterior wall, and the edges of the posterior peritoneum were brought up to the margins of the anterior abdominal wound and there sutured. The cavity thus excluded from the peritoneal space was plugged with gauze. The operation was followed by an uninterrupted recovery.

The cyst in this instance appeared to be located between the layers of the sigmoid mesocolon and behind the pelvic colon. The wall consisted of fibrous tissue, amongst which was much lymphoid tissue. No epithelial lining was determinable.

These two cases represent the typical unilocular retroperitoneal cyst, though in the first, evidence of an earlier

multilocular condition was furnished by the presence of septa which had undergone atrophic absorption. In each case the exact situation was at the root of the mesocolon.

In the following two cases the cysts were situated in the folds of the mesentery of the small intestine.

CASE III.—F. T. G., aged six. Since infancy this child had been subject to attacks of abdominal pain, the onset of pain being shortly followed by vomiting. The action of the bowels had always been regular. For six weeks before the date of admission to the hospital these attacks of pain and vomiting had been becoming more frequent and severe, the child began to lose flesh, and the abdomen became much distended.

On admission to the hospital the child, although thin, was healthy in appearance and cheerful between the attacks of pain.

On inspection of the abdomen a central prominence was apparent, and on palpation a large tumor was detected extending from the pubes upward to the costal margin, but most prominent in the umbilical region. The abdomen was dull on percussion except in the flanks and a narrow band of resonance above the pubes. The tumor was not tender, and appeared freely movable. The urine was normal.

An exploration being decided upon, the abdomen was opened by a paramedian incision four inches in length, with outward displacement of the rectus muscle. A dark-colored cyst at once presented, which was emptied of a quart of dark-colored chocolate fluid by a trocar and canula. The remaining mass was then delivered by traction on the large emptied cyst; it proved to consist of three additional thin-walled cysts, each about the size of a small orange, containing clear colorless fluid, and situated between the layers of the mesentery (Fig. 2). About three inches of the jejunum was flattened out and closely applied to one of these cysts, and as it appeared probable that stripping out of this cyst would dangerously interfere with the vascular supply of the bowel, the latter was resected and removed together with the cysts. An axial union of the bowel was then made, and the abdomen closed.

The wall of one of the larger cysts beyond the fibrous tissue contained bundles of plain muscle-fibre all passing in one direc-

tion. The contraction of these fibres had raised the internal wall of the cyst into a series of fine ridges. There was no endothelial lining. The child made an uneventful recovery.

CASE IV.—E. B., aged thirteen, was admitted into the hospital with a history of nine days' obstruction, persistent vomiting (stercoraceous on admission), and abdominal distention. By the rectum a smooth elastic mass could be felt anteriorly. Mr. Clutton opened the abdomen and removed a large group of mesenteric cysts, the largest of which involved a knuckle of the small intestine which was resected. The two ends of the divided bowel were brought out of the abdominal wound, a lateral anastomosis between them being established within by means of a Murphy button. Death ensued three days later from acute general peritoneal infection, due to sloughing and perforation at the site of the button (St. Thomas's Hospital Museum II 49 a.).

Origin and Nature of the Cysts.—These cysts are of lymphatic origin, resembling in nature the so-called hydrocele of the neck, and the multilocular lymphatic cysts of the axilla or the spermatic cord.

The unilocular cysts are usually the larger variety as far as an individual cavity is concerned, but in most cases examination of the interior shows the existence of more or less prominent ridges or septa on the wall, indicating an original multilocular condition. They are most commonly situated in a retroperitoneal position, and by appropriating to themselves the peritoneum of the mesenteries, tend to fix the corresponding portion of bowel and to encroach upon its lumen. Of the two cysts described above, one originated at the root of the transverse mesocolon, the other at the root of the sigmoid mesocolon. Such cysts have been known to change their position—thus in an instance recorded by Narath the swelling travelled downwards like a spinal abscess, and eventually reached the front of the right thigh.

The multilocular tumors are more commonly situated in the mesentery of the small intestine, and are composed of separate globular cysts of varying size.

The cyst wall is composed of fibrous tissue; in the multilocular variety the wall is often very tenuous, in the unilocular it is much thicker. An endothelial lining is frequently not demonstrable. The contents, when no secondary change has occurred, may consist in a thin, colorless, transparent, lymphatic fluid, or the appearance may be "chylous." It is noteworthy that in the first of the cases described above, although the fluid was chylous in appearance, no free fat globules were demonstrable, neither was any cellular element discovered on microscopical examination.

Secondary Changes.—Of these, simple enlargement is the most common. The rate of increase is slow, but it may be accelerated by injury. The most common accident is hemorrhage into the cyst cavity, under which circumstance enlargement may be rapid (Case II). The hemorrhages may be recurring, in which case the cyst may reach an enormous size and its wall become greatly thickened by the deposition of laminæ of fibrin. I once drained a cyst of this nature from an opening in the left loin; the contents consisted of old altered blood, while the cavity with a wall three-quarters of an inch thick had reached a size corresponding to a third of that of the whole abdomen. The cyst wall itself had become inseparably connected with the surrounding structures.

Signs and Symptoms.—Inspection of the abdomen may at once reveal the presence of a localized enlargement, while on palpation a definite elastic cystic tumor may be detected and a fluid thrill elicited. When the cyst is of the unilocular retroperitoneal variety, the position is usually a fixed one, while the multilocular cysts of the mesentery of the small intestine are more irregular in outline, and free mobility is the rule. The cysts between the layers of the mesentery of the small intestine are moreover practically central in position, while the unilocular, although generally corresponding to the root of some part of the mesentery of the large intestine, may be situated in almost any part of the abdomen.

In two of the instances recorded above, the cyst was readily palpated by rectal examination, and bearing in mind

the possibility of stretching or dragging down of the root of the mesentery from its attachment to the posterior abdominal wall, the descent of the cysts into the pelvis would naturally be expected to occur sooner or later.

Symptoms.—In the production of symptoms the behavior of these cysts closely resembles that observed in hydatid disease. For a long period a latent character is preserved, then augmentation in size of the cysts and gradual increase in the degree of pressure exerted on the surrounding viscera may give rise to pain, flatulence, constipation, or actual obstruction of the bowels. Thus in Case I symptoms of pyloric and duodenal obstruction developed, as also evidence of slight pressure on the common bile-duct, shown by the presence of bile pigment in the urine. In Case III recurring attacks of abdominal pain and vomiting were probably accounted for by changes in the position of the tumor.

The gradual nature of the enlargement of the cysts, however, allows for considerable adaptation, and serious pressure symptoms in the absence of accidental changes in the cysts themselves must be regarded as late phenomena. Cases I and II go to prove that the reception of an injury may result in a sudden or rapid increase in the size of the cysts, independent of the occurrence of hemorrhage, such increase corresponding with the development of definite pressure symptoms. In neither were the symptoms severe, but they amply sufficed to draw attention to the condition. The occurrence of intracystic hemorrhage is a more important event, for here intestinal obstruction may be acute and complicated by symptoms dependent on the loss of blood. The actual mechanics concerned in the production of obstruction of the bowel vary considerably, thus the intestine may be stretched as a broad ribbon over the prominent cyst as in Case III, the intestine may be sunk in a deep hollow between two cysts as in Fig. 3, or small individual cysts may project towards the lumen of the bowel as in Fig. 2. The tumor by its weight may drag on the intestine, or a change in position of the tumor may cause an actual kink.

Diagnosis.—The diagnosis must usually be made by the process of exclusion. A definite opinion is most readily reached in the case of young children with cysts situated in the mesentery of the small intestine; in them no other cyst in a similar high central position is often met with.

In adults a number of cystic tumors need to be taken into consideration.

Hydatid cysts perhaps form the most difficult problem, as in Case I, where the situation was especially favorable to such a diagnosis being made. No examination of the blood was undertaken, but it may be remarked that the absence of eosinophilia might have been determined as a factor in the conclusion to be arrived at.

Pancreatic cysts are usually situated somewhat higher in the abdomen, they are less movable than the central mesenteric cyst, more frequently accompanied by gastric disturbance, glycosuria may be present, also evidence of deficient pancreatic digestion on examination of the stools. Again, in the traumatic pancreatic pseudocyst, a history of really severe symptoms is usually to be obtained.

Sarcomatous cysts: In these the rate of growth is more rapid, and pain, as in the solid retroperitoneal sarcomata, is an earlier and more prominent symptom.

Cold abscess: Where the presence of a localized fluctuating tumor is the main or almost only feature, this possibility needs consideration, and the case of Narath, in which the cyst "pointed" in the thigh, shows that considerable difficulty may arise. The diagnosis will mainly depend on the detection of the primary focus of the disease by the ordinary methods employed in dealing with any obscure case of tuberculosis.

Ovarian cysts: The fact that mesenteric cysts may be readily felt on rectal or vaginal examination and that they are movable in many instances may lead to some difficulty. Case III in point of fact did very closely resemble one of ovarian cystic disease. It may be noted that rectal examination usually allows the absence of pelvic anchorage to be determined, also that elevation of the pelvis may allow the

tumor to escape from contact with the finger and take up a higher position in the abdominal cavity.

Lastly, the history and symptoms usually accompanying an uronephrosis or a distended gall-bladder should usually prevent any confusion with either condition.

Treatment.—The treatment of mesenteric cysts has been sufficiently outlined in the series of cases here reported.

The ideal procedure is enucleation of the cyst and the avoidance of any interference with the continuity of the alimentary canal. In the case of the unilocular retroperitoneal cysts, this course may usually be adopted without difficulty. If changes have led to a so firm fixation of the cyst in its bed that the dissection necessary for its enucleation gives rise to parenchymatous hemorrhage difficult to control, the method successfully adopted by Mr. Sargent in Case II is admirable.

In the case of the multilocular cysts, enucleation may be impracticable without dangerous interference with the integrity of the blood supply, or the condition of the intestine when obstruction of any standing is present may render its preservation undesirable; it may then be necessary to resect the implicated portion of the small intestine, as was done in Case III.

THE ABDOMINAL INCISION—THE REMOVAL OF THE WEDGE OF SKIN AND FAT TO FACILITATE INTRA-ABDOMINAL OPERATIONS.

BY HOWARD A. KELLY, M.D.,

OF BALTIMORE, MD.,

Professor of Gynæcology in the Johns Hopkins University.

IN an article on "Excision of the Fat of the Abdominal Wall—Lipectomy,"¹ I recommended large excision of skin and fat from the overweighted abdominal wall in obese women. Such an operation serves the purpose of reducing their avoirdupois, and at the same time renders the patient less unwieldy by taking some pounds of fat from a part of the body where it is most awkward to carry it. It is also cosmetic and serves the purpose of cleanliness. This operation, to which I gave the name "lipectomy," bids fair to be extensively used in this country as well as abroad. It has been considered by Weinhold² and by A. E. Maylard.³

Dr. Maylard, of Glasgow, in a most interesting and thoughtful article on the "Direction of Abdominal Incisions," describes two cases in which abdominal walls were resected, removing ten pounds and eleven ounces, and six pounds and two ounces, respectively, the incision in each case being 21 inches in length.

A number of surgeons also in our own country, without having specially reported their cases, have relieved excessively obese patients by a similar procedure.

The matter I now wish to speak of, though bearing a superficial resemblance to the operation of lipectomy, is rather an adaptation of the same idea to another field and for quite another purpose.

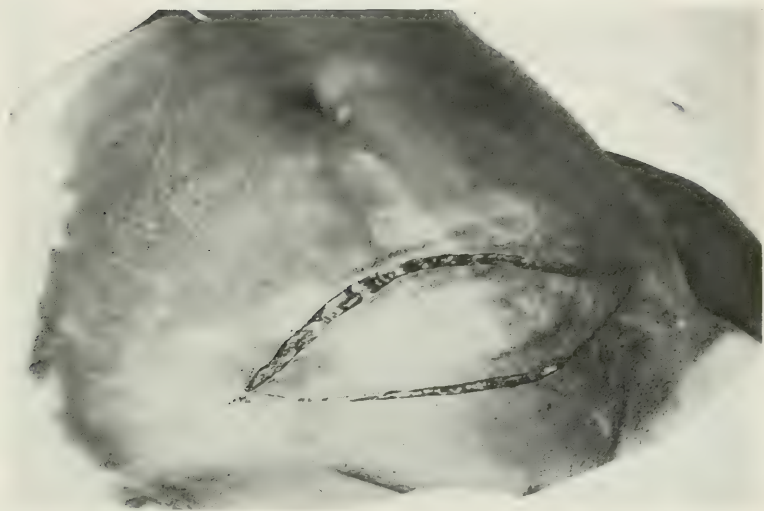
Every surgeon knows well how the difficulties of intra-

¹ Surgery, Gynæcology, and Obstetrics, March, 1910.

² Cent. f. Gyn., No. 38, Sept. 18, 1909, p. 1332.

³ Brit. Med. Jour., Oct. 5, 1907, p. 895.

FIG. 1



Oval incision for the removal of a sector of skin and fat to get the embarrassing superficial tissues out of the way in operating upon the deeper abdominal structures. The dark color of the abdomen is due to the tincture of iodine.

FIG. 2.



The wedge of skin and fat being lifted away, the upper part of the incision is hauled up, showing the extent of the linea alba, which is accessible for a vertical incision into the abdomen even when the skin and fat are removed transversely.

abdominal operations in a stout patient are often greatly enhanced by thick abdominal walls which increase the distance of the tissues to be treated from the surface, compelling the operator to work, as it were, through a long funnel. On the other hand, almost all abdominal operations, however difficult, if they could be transported onto the surface of the body, would become comparatively easy. Any one, for example, could cut into a common duct and sew it up or lay bare a pelvic ureter without injury if these structures were disposed, for example, close to the surface of the body. The more distant the structure is from the superficial plane of the body the more difficult those delicate operations become, just on account of the remoteness and for no other reason. In some cases actual suturing is made impossible by nothing else than these vexing mechanical difficulties of the situation, the unget-ativeness of the parts, so to speak. This awkwardness I have been able to obviate in most instances by a large oval excision of the skin and fat down to the abdominal wall, removing a skin section either in a transverse or in a vertical direction, corresponding to or at right angles with the incision, about 8 or 10 inches in length by 3 or 4 inches in width. This does away with the thickness of the wall down to the fascia, while from the fascia inwards the difference between different abdomens is not great. If the patient is excessively fat, one will then naturally do a regular lipectomy operation, such as I have described in my previous article. This serves the same purpose and is done the same as the lesser procedure here described. I wish, however, here to emphasize the value of removing wedges of skin and fat in patients who are not troubled with obesity, but simply and solely for getting rid of a part of the thickness of the abdominal wall and making the field of the operation more accessible.

An oval or an elliptical excision is made such as that figured (Figs. 1 and 2), cutting right down to the strong fascia overlying the rectus and oblique muscles. All bleeding vessels ought to be carefully tied. It is a good plan, I think, to slope the edges of the incision a little inwards. When this

piece of skin and fat is removed the operator then finds it much easier to open the abdominal wall and operate than in a similar case where he has to retract this embarrassing mass of tissue as well.

I like to close such a wound with a fine catgut suture, catching a distinct layer of fascia about the middle of the fat, silkworm gut sutures uniting both skin and fat.

SUPERNUMERARY KIDNEY SUBJECT OF CYSTADENOMA.

REPORT OF A CASE VERIFIED BY OPERATION.

BY FARRAR COBB, M.D.,

AND

HAROLD G. GIDDINGS, M.D.,

OF BOSTON, MASS.

THE case reported is unique so far as the writers have been able to find. Cases of supernumerary kidney in themselves are very rare. We have found recorded in all literature but seven such, and in two of these the extra kidneys were fused with one of the normal ones. The rarity of the condition makes the case distinctly worthy of presentation, the more so because the supernumerary organ was not only well developed, which was true in none of the other cases, but because it revealed a pathological condition (papillary cystadenoma) distinct, definite, and in itself comparatively rare as a form of renal tumor.

The operation which revealed this unusual pathological condition was undertaken for the removal of a very large abdominal tumor the nature of which was uncertain before the operation.

CASE.—G. R. F., June 25, 1909, sixty-seven years, married. Carriage driver. Born in Maine where he has always lived.

Family History.—This contained nothing of importance except the following curious statement: the patient was one of twin brothers, the other of whom had died and at the autopsy was found to have only one kidney. The cause of death in the brother's case was not known, and verification of the facts was impossible.

Past History.—Unimportant.

Present Illness.—About two years ago, while "rolling a

trunk," patient was seized with a sudden, severe pain on the left side of the abdomen extending into the flank. This soon passed off, but left him feeling weak for a number of days, and soon after he noted a "bunch" on the same side. This has been present constantly since that time, but not always of the same size; has been larger at night than in the morning, and apparently larger after its possessor had been working. Pressure of gas in the intestines makes it "feel big." The tumor is painful when the bladder is full and there is a sense of pressure on the growth. Voiding of urine gives some relief, but there remains afterward a slight soreness about the tumor; the voiding of urine does not, however, reduce the size of the swelling. The urine has always been clear. At no time have there ever been any other urinary symptoms.

Physical Examination.—A tall, rather spare man; color good; no evidence of cachexia. No glandular enlargement anywhere.

The entire left half of the abdominal cavity and about one-half of the right portion was occupied by a tumor mass, the longest diameter running diagonally from left to right, and from above downward. The tumor was firm, somewhat elastic, not notched, smooth, flat to percussion, slightly tender when firmly pressed down, and did not change its relative position when the patient changed his. It did not move with respiration; it gave no fluid wave. It was impossible to get well in behind the mass. There was no tenderness in the costovertebral angles. The veins in the abdominal wall over the mass were enlarged; the picture resembled that of a large ovarian cyst, as a distinguished German surgeon, who examined the case before operation, facetiously remarked. When the stomach and colon were inflated they were found lying over the tumor.

Urine: Normal color, acid. Specific gravity 1030. No sugar; no albumin. Nothing in the microscopic examination.

Blood: White count 15,000. Stained specimen normal. Differential count: polymorphonuclears 67 per cent., lymphocytes 32 per cent., eosinophiles 1 per cent.

Diagnosis.—Before operation the diagnosis was uncertain. It was impossible to differentiate between a large cyst of the pancreas, a mesenteric cyst, a tumor of the kidney, or some new growth from the retroperitoneal glands. It seemed fair to

assume that the tumor was retroperitoneal, and the diagnosis of choice was pancreatic cyst.

Operation.—This was done by Dr. Cobb at the Massachusetts General Hospital on June 29, 1909. A six-inch incision was made in the median line. The tumor was found to be retroperitoneal. The overlying peritoneum was opened, a trocar inserted into the growth but nothing obtained. An incision was then made into the mass, and after a large amount of necrotic, grumous material had been removed, it was discovered that the growth was in the main a cyst filled with dark, thick fluid and debris, but that this cystic portion sprang from a solid mass which resembled a kidney.

The mass lay beside the inferior vena cava, to which it was closely adherent and from which it was with great difficulty freed. No ureter could be found. After complete removal of the growth, a large gauze drain was left in and the wound closed in layers. When, from the gross appearance at the operation, it seemed probable that the tumor was a cyst containing kidney tissue, careful search for the right and left kidneys was made with the result that both were seen and palpated.

Pathological Report.—Dr. F. C. Kidner, one of the pathologists at the Massachusetts General Hospital, made the following written report:

“A tumor 18 cm. in its greatest diameter. Included in one side of the wall is a flattened, rather enlarged kidney which on section is apparently normal. The tumor evidently had grown from one pole of the kidney. No ureter is to be made out. On opening the tumor it is found to consist of a sac of fibrous tissue entirely filled with a granular cellular mass apparently without structure. At the periphery a certain amount of this cellular material is adherent, and evidently grows from the capsule. This is also true on the kidney side, where the growth sprouts directly from the kidney substance. The material in the mass is yellowish and seminecrotic in character.

“*Microscopic examination* of a piece removed from the junction of the kidney and the tumor shows kidney tissue largely replaced by connective tissue and markedly inflamed. Growing from this is a mass of vascular, papilloma-like tissue, suggesting, under the lower power, papillary cystadenoma.

Under the higher power the growth appears as single layers of cells covering on both sides stalks of fibrous tissue, each of which carries a small blood-vessel. The individual cells are of the low columnar type, with slightly ovoid vesicular nuclei, and evidently belong to the epithelial series. Mitotic figures are extremely common.

“Diagnosis.—Papillary cystadenoma of the kidney.”

In Fig. 1 the kidney tissue with the distinct glomeruli can be seen, and in Fig. 2 is shown the border line between the renal tissue and the fibrous structure of the new growth.

This case is of particular interest because the third kidney was fully developed; because the other kidneys were both seen and felt, which is not true of all the other cases reported; because it had its own separate blood-vessels, but lacked a ureter, and because of the pathological condition for which the operation was done. One and a half years after the operation the patient was in excellent condition and able to do his work as a driver of carriages.

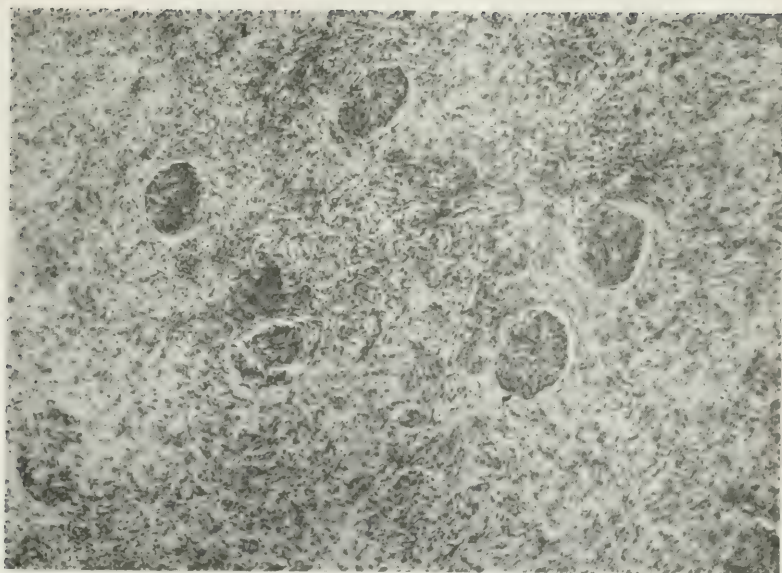
Quain's "Anatomy," tenth edition, makes casual mention of the fact that the occurrence of additional kidneys is extremely rare, but that they may appear either on one side or the other of the vertebral column or in the pelvis. A few cases of supernumerary kidney have been reported.

WATSON CHEYNE reported a case, which in some respects resembles that of the writers. Cheyne says that the supernumerary kidney was discovered during a laparotomy, it was structurally well developed, was situated in the right side at the lower part of the spinal column just above the pelvic brim three or four inches below the normal kidney on that side, and was freely movable and had its own ureter and blood supply. Cheyne's opinion was that the symptoms of abdominal pain and indigestion, for which his operation was undertaken, were caused by the mobility of this supernumerary kidney.

DEBIÉRRE related a case of Gavard's where there were three kidneys situated over the lumbar spine and the ureter of the central kidney opened into the ureter of the right. This extra kidney was a small pear-shaped body near the upper margin of the left kidney. It had a distinct ureter, which entered the regular one on the same side about half an inch below the latter's exit from its kidney.

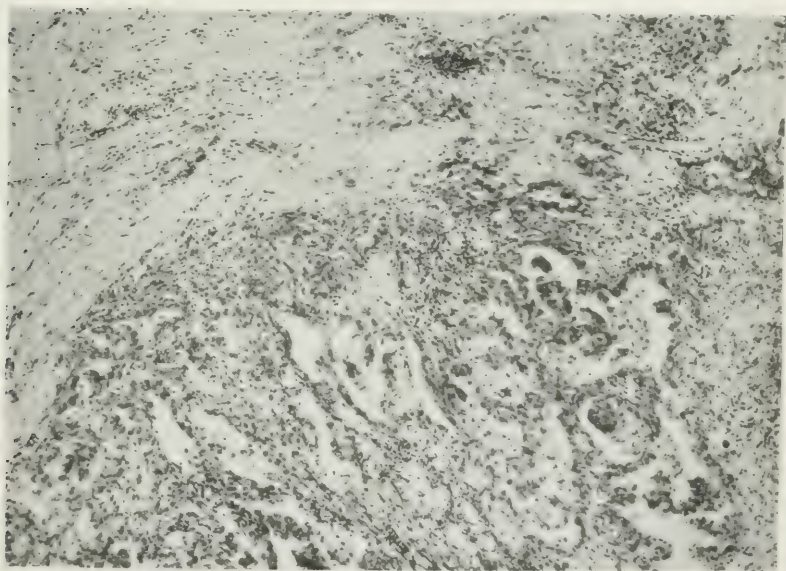
In a case reported by the Surgeon-General of the Marine-Hospital Service, a miniature kidney occupied the hilum of the left kidney, being

FIG. 1.



Section from that part of the tumor which resembled normal kidney tissue, showing glomeruli.

FIG. 2.



Section showing boundary zone between normal kidney tissue and the capsule of the cystadenoma.

supplied with a short ureter which ran into that of the parent organ. It was three-fourths of an inch long and half an inch wide, and weighed about 1.5 grammes.

NEWMAN has reported an instance of supernumerary kidney found postmortem in a male subject who had died of malignant disease of the colon. It was a small pear-shaped body lying close to the upper margin of the left kidney, receiving its blood supply from a branch of the renal artery, and possessing its own distinct ureter, which passed into the left ureter half an inch below the pelvis of the left kidney.

BARTLETT reported an instance of supernumerary kidney. Two kidneys on the left were fused together, though each had its own ureter arising separately from its own pelvis and continuing so to the bladder, one entering it a quarter of an inch above the other. On section a distinct demarcation of the two kidneys was not visible to the naked eye; all three were normal in appearance.

TSCHUNDY has placed on record a case of complete double formation of one kidney, the upper portion of which was distended and septic, the lower part being perfectly normal.

MUNRO and GODDARD reported in 1907 a case of "Pyelonephrosis of a Supernumerary Kidney" in which the patient, a young man of twenty-three, had had indefinite abdominal symptoms from the time he was three months old up to the age of eighteen years. From then for the next five years he was free from symptoms, at the end of which time they forcibly returned, together with a large tumor. Operation was undertaken in two stages. A cystic condition was relieved by drainage, and later a sac was dissected out from the pelvis where it lay attached by a ureter to the bladder. It was first thought to be a cyst of the urachus, but the pathological report stated that the tissue consisted of a cyst lined with stratified epithelium similar to that in the pelvis of the normal kidney. The thicker portions of the wall were composed of easily recognized renal tissue, containing numerous glomeruli, separated from one another by masses of tubules. In these places the amount of connective tissue between tubules corresponded to that of normal kidney. For the most part the tubules did not show normal epithelium, though occasionally they did. The whole picture was one of hydronephrotic kidney.

This case of Munro and Goddard's in certain respects resembles that of the writers'; in each instance there existed a large cyst, though in the one presented here there was apparently much more kidney tissue than in the other, for in the latter, the nature of the growth was not recognized until the pathologist's report had been obtained, whereas, in the writers' case, as already pointed out, the cyst grew from a supernumerary kidney, which grossly as well as microscopically resembled a normal one.

In Munro's case both right and left kidneys were not seen or palpated. The presence of the right was determined by X-ray photographs after operation. Although there can be little if any doubt that two other kidneys were present in this case, it would have been more satisfying if other proof than X-rays could have been obtained. Munro and Goddard did not suspect the renal origin of the cystic tumor, whereas in the writers' case it was apparent during the operation that an anomalous kidney was connected with the tumor.

REFERENCES.

- Cheyne: London Lancet, 1899, v. i, p. 215.
Munro and Goddard: Am. Jour. of Med. Sciences, Sept., 1907.
Munro, John C.: Boston Med. and Surg. Jour., March 31, 1910.
Report of Marine Hospital Service, 1885, p. 148.

THE DAMAGE DONE TO THE KIDNEY BY OPERATION.*

BY JAMES E. MOORE, M.D.,

OF MINNEAPOLIS, MINN.,

Professor of Surgery in the University of Minnesota,

AND

J. FRANK CORBETT, M.D.,

Assistant Professor of Surgical Pathology in the University of Minnesota.

At a meeting of this Society last year, a paper was read upon essential hemorrhage of the kidney,¹ in the discussion of which a great variety of technical methods was described, and during which the question naturally arose, "How much is the function of the kidney interfered with by the various operations advised, and of these operations which does the least damage?" The present paper reports an effort to answer these important questions by experimental deduction.

With our present excellent surgical technic, we are able to operate upon all of the organs of the body usually without causing the immediate loss of the patient's life. The tendency is, therefore, to perform some very heroic operations, many of which doubtless do great damage to the organs. Especially is this true when operating upon the kidney. We can remove one kidney and have the patient live, but it is yet to be demonstrated that the health or life expectancy of a person with one kidney is as long as it would be if he had two. We question whether any life insurance company would insure a person who had had one kidney removed, even if it had been removed on account of traumatism.

To take up in more detail the question of operation wounds of the kidney: at least two general routes for kidney exploration are possible, first, section of the pelvis (so-called

* Read before the Academy of Medicine in Minneapolis, Oct. 7, 1910.

¹ ANNALS OF SURGERY, vol. xlix, p. 618.

pyelotomy) and second, section of the kidney substance (nephrotomy).

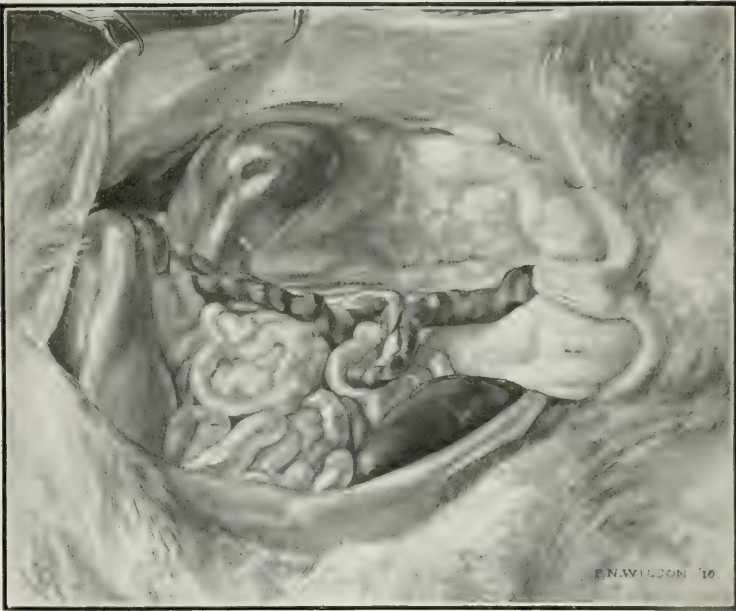
The tendency of the epithelium of the normal pelvis of the kidney to proliferate enormously when cut and continuously irritated deters somewhat from this route of exploration. As an example, in a pyelotomy done by one of the authors on a dog, the proliferated epithelium resembled a malignant growth. Pease states that some such epithelial proliferation is the rule when the normal pelvis is opened, and in one of the animals operated by Pease the pelvic epithelium proliferated to such an extent as to line the entire wound with squamous cells, producing a permanent fistula. While this is probably less apt to occur in a pelvis in which the epithelium has been extensively damaged by long-continued irritation, such as might result from a large stone, this objection yet remains for exploring the kidney with a nearly normal epithelium lining the pelvis. The flap of fatty tissue recommended by Mayo has somewhat lessened the chance of fistula.

Pyelotomy, according to Eisendrath, Perineau, and others, is limited to cases in which there is no infection and in which there are no very large stones.

Nephrotomy, on the other hand, always results in some destruction of kidney substance. However, the operation of nephrotomy cannot be entirely done away with. For this reason experiments were undertaken to ascertain the amount of damage done to the kidney by various methods of kidney suture, together with a study of the loss of function resulting from such procedure. The work was done entirely on the kidneys of rabbits. *All animals operated on were under full ether anæsthesia.* Incisions were made from pole to pole in the median line, extending through the kidney substance. These were sutured by one of the following methods:

1. Continuous suture of the capsule only.
2. Continuous mattress sutures, in which the suture material was introduced parallel to the cut and this procedure repeated until the tissues were approximated.

FIG. 1.



Kidney sutured by Method I. This figure shows large accumulation of blood about sutured kidney, occurring between the peritoneum and the muscles of the posterior abdominal wall.

FIG. 2.



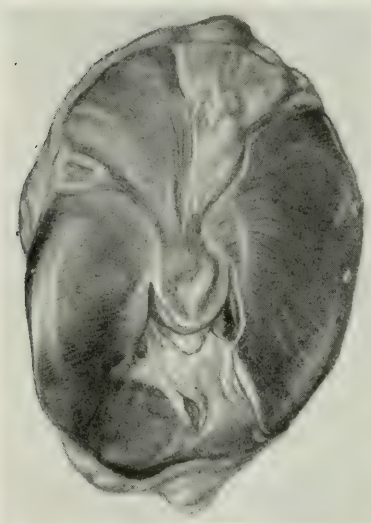
Kidney sutured by Method II. Transverse section cut at right angles to long diameter. The gross changes indicate only a part of the actual damage to the tissue.

FIG. 3.



Kidney sutured by Method II at the end of 37 days. The scar has become sufficiently old to cause shrinkage and deformity of kidney. Size of kidney about two-thirds that of normal.

FIG. 4.



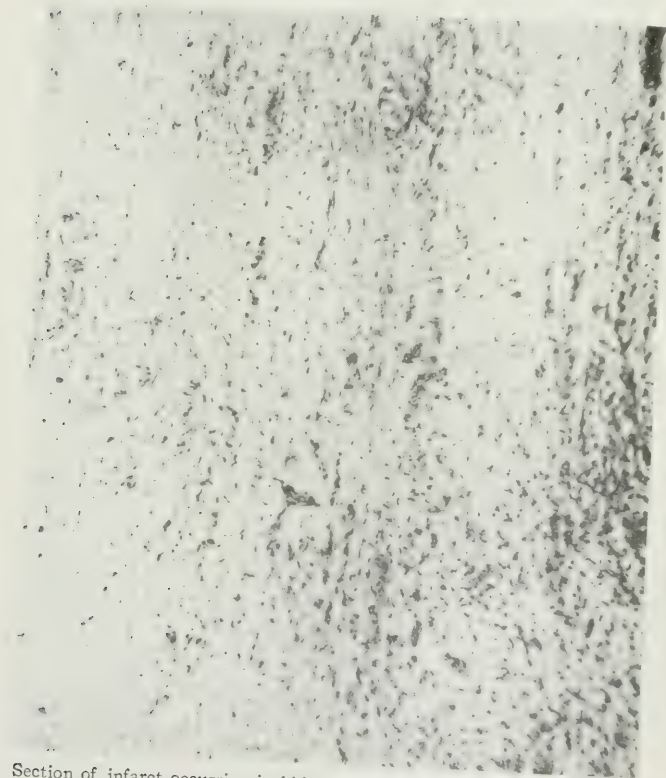
Transverse section of kidney operated on by Method III. Shows narrow and sharply defined infarct as it occurred ten days after suture.

FIG. 5.



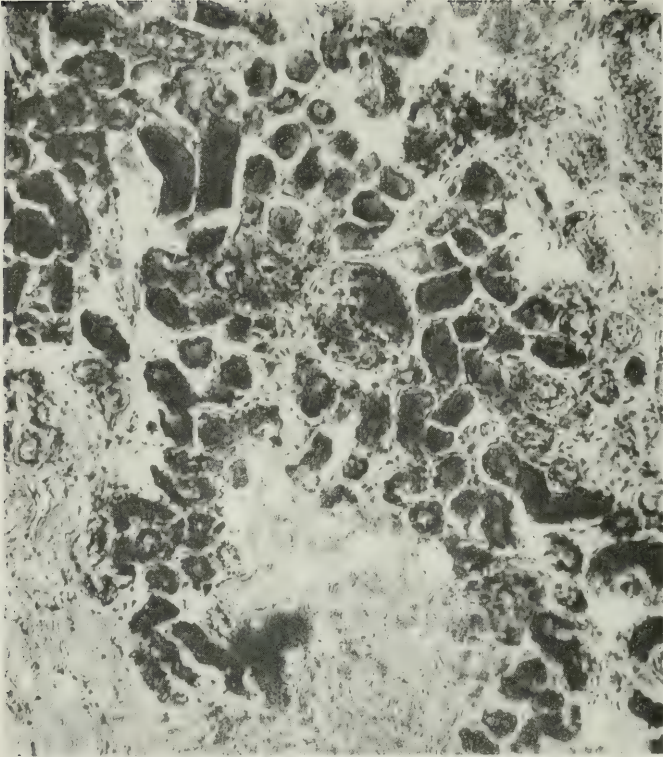
Kidney sutured by Method III. Result of too tight ligatures.

FIG. 6.



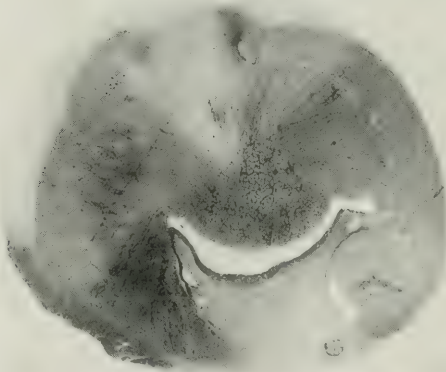
Section of infarct occurring in kidney sutured by Method II. This consists of newly formed connective tissue originating from the capsule.

FIG. 7.



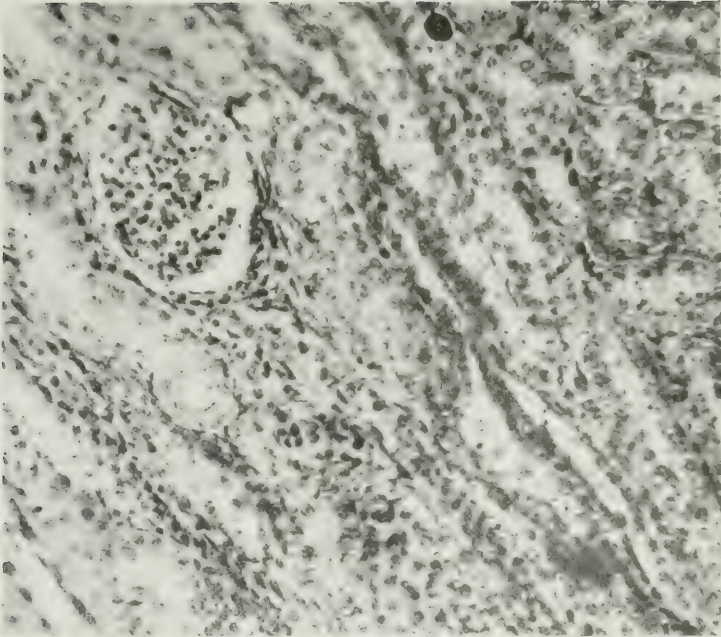
Kidney sutured by Method II at the end of 37 days. Shows degenerated tubules in scar. Also a single surviving glomerulus.

FIG. 8.



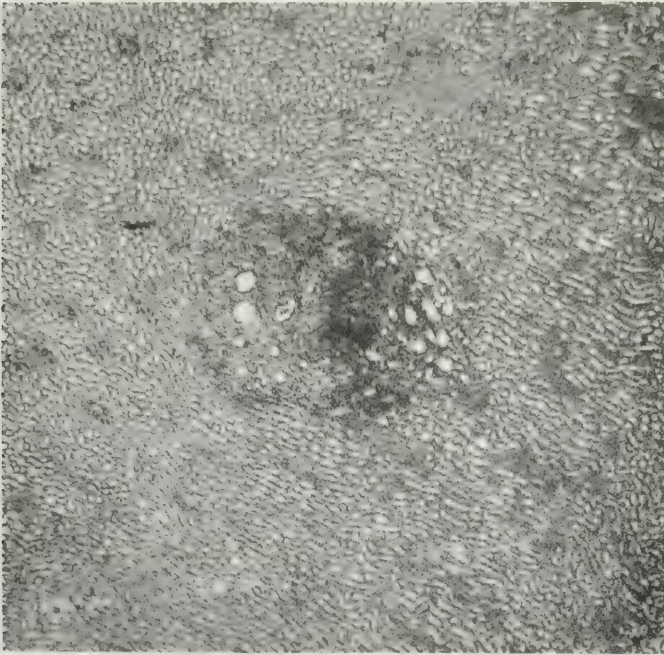
Kidney sutured by Method II at the end of ten days. The damage extends far beyond tissues between two catgut sutures seen in picture.

FIG. 9.



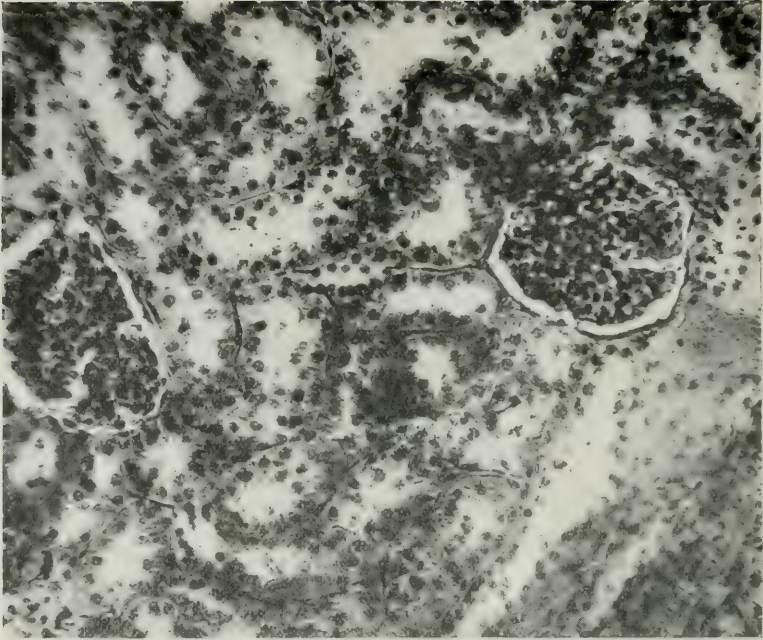
Kidney sutured by Method II at the end of 90 days. Remote from region of suture.

FIG. 10.



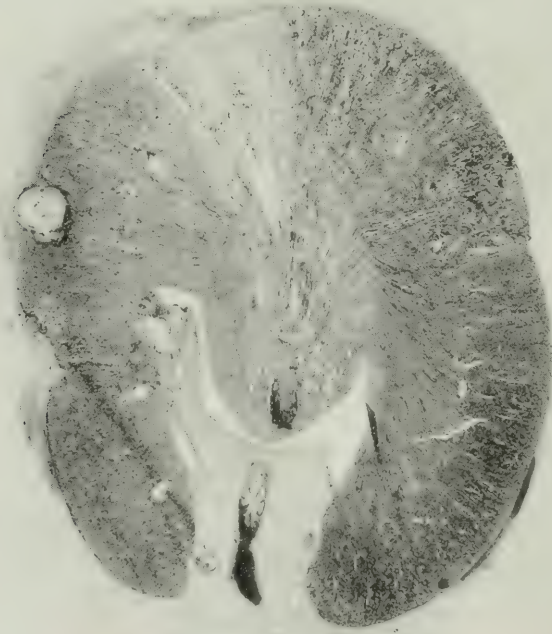
Kidney sutured by Method III. Shows extent of damage done by ligature used to transfix kidney.

FIG. 11.



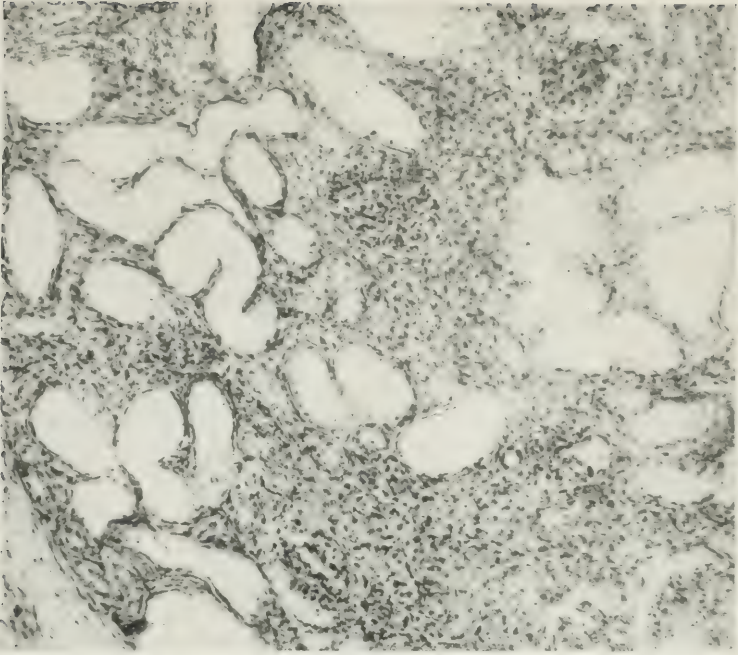
Kidney sutured by Method III. Appearance of kidney remote from sutures.

FIG. 12.



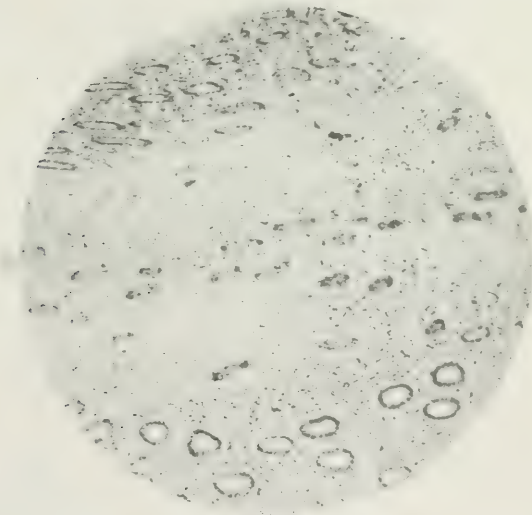
Transverse section of kidney sutured by Method III at end of ten days.

FIG. 13.



Kidney sutured by Method II at the end of 90 days. Portion of kidney remote from line of suture.

FIG. 14.



Masses of epithelial cells found in the scar of kidney operated upon by Method II at end of 37 days. These resemble in every way new formed tubules.

FIG. 15.

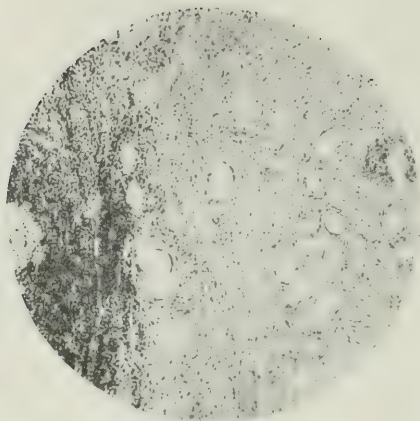
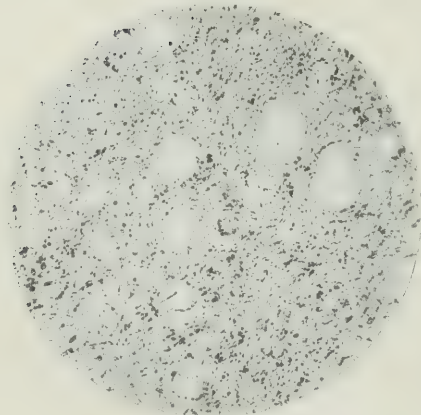
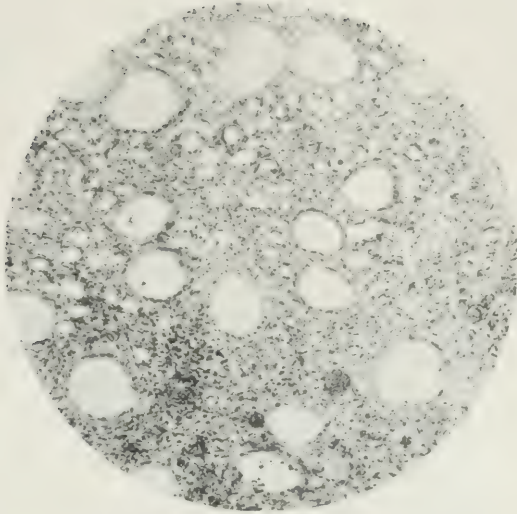


FIG. 16.



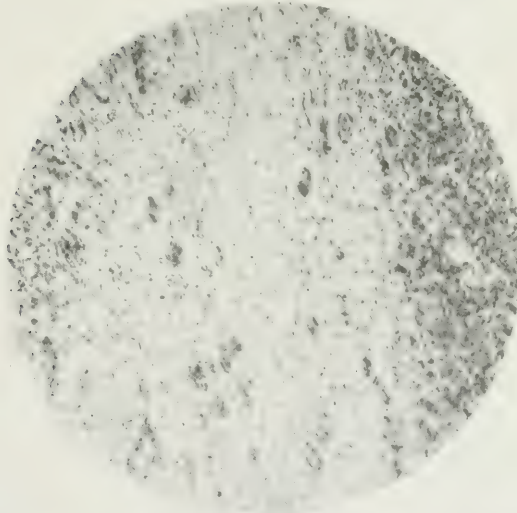
Sections showing the formation of cysts from cell masses occurring in the scar of a sutured kidney after 37 days.

FIG. 17.



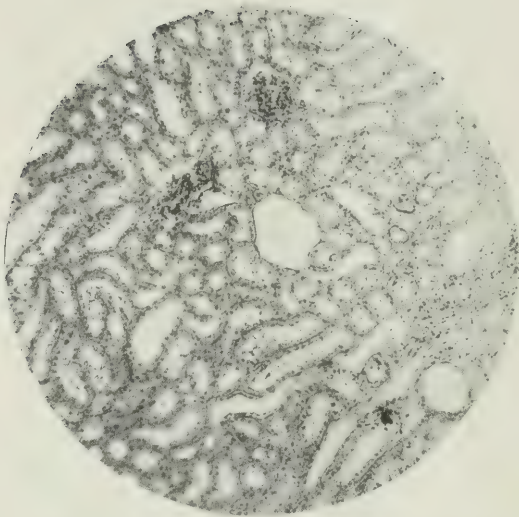
Section showing the formation of cysts from cell masses occurring in the scar of a sutured kidney after 37 days.

FIG. 18.



Section showing atrophic change in the cell masses included in the scar of a sutured kidney 37 days after operation.

FIG. 19.



Section taken at the margin of scar occurring in kidney
sutured, Method III, at end of 37 days.

3. Interrupted sutures transfixing the kidney at the pyramidal line and tied around the body of the kidney. Three sutures were usually used in the case of rabbits, great care being taken to employ only enough tension to coapt the cut surfaces. The operated animals were killed at the end of 10, 37, and 90 days, and the kidneys carefully studied.

METHOD I.—In the experiments in which the capsule only was sutured, in two instances large and fatal hemorrhages occurred soon after the operation. The result of this hemorrhage is shown in Fig. 1, as seen from the peritoneal side. As the essential function of the suture is to control hemorrhage, a simple suture of the capsule does not recommend itself.

METHOD II (Mattress Suture).—In the second method, both single and double nephrotomies were performed. In the single nephrotomies at autopsy great disparity in the size of the kidneys was noted. At the end of ten days the average weight of the operated kidney was found to be seven grammes, of the unoperated kidney twelve grammes. This apparent compensatory hypertrophy was carefully studied, and the following conditions were noted in the intact kidney where a nephrotomy had been done on its fellow: there was no demonstrable increase in the number of glomeruli, the blood-vessels were dilated and somewhat larger than normal, and Bowman's capsule was separated by a considerable space from the glomerular tufts. These findings suggest congestion rather than kidney reproduction.

The sutured kidney cut at right angles to the line of suture showed a large, wedge-shaped infarct including over one-third of the kidney substance. This at the end of ten days is shown in Figs. 2 and 8. On microscopical study it was found that the damage to the kidney was much more wide-spread than the gross lesion indicated. On histological examination of such a kidney ten days after operation, the infarct apparent in the gross section was found to be composed of necrosed kidney substance (Fig. 7), surrounded by connective-tissue cells that had grown in from the capsule (Fig. 6). Outside of this infarct was a sharp transition to a second zone, in which were seen dilated tubules occasionally having some exudate in the lumina, flattened glomeruli with thickened capsules, swollen convoluted tubules, and considerable connective tissue.

The histological study of the kidney remote from the line of suture showed the glomeruli dilated and surrounded by hyaline masses of degenerated capsular cells. The tufts in other places did not fill their capsules. The number of glomeruli was apparently diminished. Convoluted tubules were increased in size, and conducting tubules were dilated and deformed. In areas there was considerable lymphoid cell infiltration.

The gross deformity of the kidney increased with time after this operation. Fig. 3 shows a transverse section through an operated

kidney at the end of thirty-seven days. In this may be seen completely formed scar tissue. The most striking feature in the sections taken at this stage of repair was the occurrence of masses of epithelial cells in the scar tissue. These showed evidence of active proliferation, and resembled in every respect the straight tubules. This tendency toward regeneration of parenchyma is but short-lived, however, for in portions of the same kidney we found these masses surrounded by scar tissue, beginning to show cystic and atrophic changes (see Figs. 14, 15, 16, 17 and 18).

At the end of ninety days there was a dense connective-tissue scar at the site of the operation. In this there were only remnants of straight tubules with but a semblance of their original histological detail. The glomeruli in the second zone were often surrounded by a marked lymphoid infiltration. In portions of the kidney remote from the incision there was much deformity of the kidney tubules, with a large amount of connective tissue (see Figs. 9 and 13).

Experiments are being done to determine the nitrogen output after operation by Method II. In these experiments a nitrogenous equilibrium is first established, the animals are then operated, the urine collected at various periods of time, and analyses made.

The protocols of these show great variation in the amount of nitrogen excreted by operated animals. Taking the work of Pearce, who has shown the effect of reduction of kidney substance on nitrogen output, as a basis, we are led to believe that a large part of the functioning kidney, as far as the excretion of urine is concerned, has been lost. Evidences of any loss of function depending upon internal secretion are wanting in our experiments. This apparent chemical corroboration strengthens our belief in the histological demonstration that great damage has been done.

METHOD III.—In the kidneys operated on by Method III, in gross transverse section only a very narrow and sharply defined infarct appeared on the tenth day (Fig. 4). On histological examination the damage done seemed to be nearly confined to this small area of infarction (Fig. 19). In addition to this, however, there were damaged areas in the remote portions of the kidney made by the needle puncture. That the destruction of tissue from these ligatures was very slight may be seen in Fig. 10. The apparent ingrowth of the straight tubules and the other histological changes in the immediate region of the incision were much the same as in the last method, but were much less extensive. The remote portions of the kidney maintained a nearly normal condition except for the lesion suggesting congestion (Fig. 12). There was no

general connective-tissue production such as occurred in the cases operated on by Method II.

When a single kidney was operated on by this method, the remaining kidney increased in weight but to a very slight degree, from 7.5 to 9 grammes, while the increase in Method II was from 7 to 12 grammes. The protocols on the nitrogen output confirm the histological findings.

In the kidneys removed several months after this operation, in some instances only a slight line of scar tissue remained, accompanied by very little deformity. In this method much depends on the technic employed. Where excessive tension is used (Fig. 5), or where the tissues are traumatized to a considerable degree, as serious lesions follow this method of suture as do the preceding method, but with careful technic excellent results are obtained.

To recapitulate, these experiments clearly demonstrate:

First, that an operation upon the kidney always destroyed some kidney substance.

Second, that the section of the kidney did less harm than the suturing necessary to control hemorrhage.

Third, that suture of the capsule alone was not sufficient to control the hemorrhage and is therefore dangerous.

Fourth, that mattress sutures destroyed a great deal of the kidney substance, and that the enlargement of the unoperated kidney after a short time was due to congestion from overwork and not to increased kidney substance, showing that the sum total of kidney substance is reduced by an operation.

Fifth, that the destruction of kidney substance extended far beyond the field of operation.

Sixth, that the functional activity of the operated kidney was somewhat reduced, and this resembles the finding in a contracted kidney due to other causes.

Seventh, that interrupted sutures transfixing the kidney at the pyramidal line and tied around the body of the kidney did the least damage, and this method therefore is the method of suture to be recommended.

Eighth, the use of a figure eight suture penetrating the capsule only has been suggested by Dr. John W. Draper Maury in discussing this paper. Experiments are now being done to show the result of such a suture.

EMPHYEMA OF THE URETER.

BY H. A. FOWLER, M.D.,

OF WASHINGTON, D. C.

THE question has been raised whether or not the persistence of normal contractions in the ureter following a supposedly complete removal of the kidney of the corresponding side is evidence of some remaining kidney substance.

In the course of a cystoscopic examination, in cases of grave unilateral renal lesion, one not infrequently observes that the trigone on the affected side remains motionless, the ureteral opening is rigid, and nothing is seen to escape from the ureter. The difference in the appearance of the two sides of the trigone is often pronounced. The contrast is particularly striking when indigo carmine has been used. Jets of deeply colored urine escape from the normal opening at frequent intervals and with force. The opposite side remains at rest and nothing escapes from the opening.

This phenomenon I have observed many times in cases of stone in the pelvis of the kidney, stone in the ureter, unilateral tuberculosis, and in one case of a large abdominal tumor which pressed upon and completely occluded the lumen of the right ureter. It is natural to suppose that the removal of a kidney, which throws out of function the ureter on that side, is followed, in the course of time, by atrophy of the latter. That this is true seems evident from the literature, which contains, so far as I know, no mention of the persistence of contractions in such a ureter. This applies to cases of simple nephrectomy where the ureter is not dilated or badly diseased. In a case of nephrectomy where the ureter which is left behind is dilated or badly diseased, or possibly contains a stone which was overlooked, the conditions are quite different. It is possible, under such circumstances, that the presence of infection or of a

foreign body may be sufficient to keep up irritation in the ureter and cause a persistence of peristaltic contractions, even after the complete removal of the corresponding kidney.

The following observation is unique in my experience and is of interest as bearing upon this particular question. The case is reported in detail as it presents other points of considerable interest. I have seen no mention in the literature of a similar observation. The history of our patient follows:

Wm. S., aged 41, physician. His health was good up to 1895. At this time he developed the first symptoms referable to the urinary apparatus. He first suffered with chills and fever, which were thought to be due to malarial fever. Associated with these attacks, however, was considerable pain in the left kidney region. In 1898 he noticed that the last few drops of urine were whitish and contained gritty material. In 1900 he passed the first stone *per urethram*. At this time he was suffering from typical attacks of renal colic. After such an attack, on the same day or following day, he would pass a stone from the bladder. These attacks were repeated at intervals of a few weeks up to 1905, when he passed a stone from the kidney too large to escape from the bladder. Litholapaxy was done under ether, and material weighing five grains was removed. A few days later a second crushing operation was performed to remove a portion of the stone left at the first séance.

In 1906 he had a severe attack lasting six days, and followed by the escape of a "quart" of pus from the bladder. A few days later a stone became impacted in the perineal urethra and had to be removed by perineal section. Two days after this operation, another calculus was caught in the urethra, but was finally removed by the use of cocaine and oil. He continued to pass stones at intervals up to 1907, when he first came under my observation. I was asked to see the patient in consultation to determine the condition of his kidneys. A cystoscopic examination revealed a left pyonephrosis, pus was squeezed from the ureteral opening with each contraction of the ureter in the form of a round, worm-like mass. An X-ray examination disclosed a calculus in the left kidney and another in the upper portion of the left ureter.

Further notes on my examination at that time have been lost, but evidently the right side was normal, as nephrectomy was advised and accepted. Dr. Balloch, of Washington, removed the kidney, which was so large as to require resection of the last rib for its removal. The ureter was greatly dilated to a tube fully 1.5 cm. in diameter. It was ligated and the stump cauterized. No attempt was made to remove it as the patient's condition did not justify any further interference, and the presence of the calculus in the upper portion of the ureter was overlooked. The secreting substance of the kidney was completely destroyed, and the whole transformed into a pus sac enclosing a large phosphatic calculus. The calculus was enveloped by a quantity of thick, creamy material and masses of thicker, firmer débris too large to pass the dilated ureter.

Since this operation in 1907 the patient has been free from symptoms referable to the kidney or bladder, except for the passage of blood-tinged urine on one or two occasions during 1909. He has had no attacks of renal colic, and has passed no stones. He came under observation again in February, 1910, when he was admitted to the hospital suffering with anuria. He then stated that on February 1, he began to suffer with general muscular pains and severe headache lasting four days, but with no symptoms referable to the kidney. On February 14, complete anuria developed. He was admitted to the hospital at the end of the third day of complete anuria. At that time he was drowsy, stupid, and complained of severe headache and deep pain in the right loin. On the following morning, while preparing him for cystoscopy, he passed 500 c.c. of urine, the first urine voided in three days.

Cystoscopy revealed a badly inflamed bladder, particularly marked over the base, but no ulcerations were seen. The picture presented by the ureteral orifices was most striking. From the right ureter a worm-like plug of pus was escaping, being forced out by each contraction of the ureter, and coiling up on the base of the bladder. This plug completely filled the orifice of the ureter so that no urine escaped. Turning now to the left side of the trigone, an exactly similar picture was seen. The orifice was completely filled by a plug of pus which extended to the floor of the bladder in unbroken continuity, where it was coiled up like a worm. In watching the orifice, the ribbon of pus was seen

to be extruded intermittently with each contraction of the ureter. As no urine was escaping from the right side to cloud the field, opportunity was offered for a prolonged inspection, and to demonstrate the striking, and to us unique, condition to several members of the staff present. The ureter on the left side continued to expel the worm-like mass of pus intermittently with each contraction during the whole time of the examination, which was purposely somewhat prolonged. It was evident the anuria was produced by the complete plugging of the right ureter by a plug of pus too thick to permit its ready escape. Pressure was therefore made over the right kidney. Immediately there was a rapid escape of the plug of pus, resembling in a striking way the escape of ointment from a collapsible tube when pressed upon vigorously. This lasted for a considerable time and was followed by a gush of urine and pus which soon obscured the field.

Following the cystoscopy, the patient passed a large quantity of urine, over 100 ounces during the next twenty-four hours. The temperature, which rose to 102 on the morning of the examination, fell to normal in the evening. The leucocyte count on that date was 10,600. For several days his condition was much improved, the kidney drained well, but pain in the region of the remaining kidney persisted. On February 23 he complained of uneasiness in the bladder and penis, as though a stone were present in the bladder. A second cystoscopy revealed the same condition of the left ureter as just described. Pus was also escaping from the right side, together with considerable urine, but it was evident that drainage was not free. There was an irregular mass lying on the trigone just behind the internal urethral orifice, white in color, and looking like a mass of pus which had escaped from the ureters. An X-ray examination of the kidney was negative for stone. He voided no urine from 5 P.M. of the twenty-third until 4.45 P.M. of the following day, when he passed only 10 ounces. The temperature at that time was 101.2, pulse 100. He did not void again until midnight, when he passed four ounces. No more urine was voided nor was any obtained by catheter before operation, which took place on the morning of the twenty-sixth, although repeated attempts were made to free the ureter by massage over the kidney and along the ureter. At the time of the operation the temperature was 97 and the patient was complaining of severe pain in the right kidney.

Operation (Feb. 26, 1910).—Under local anæsthesia the kidney was exposed through the usual oblique incision. The fatty capsule was very thin, and the kidney was found directly under the incision. Chloroform was now given, and the operation continued while the patient was going under the anæsthetic. The kidney, which was tremendously enlarged, was readily exposed by stripping off and pushing forward the peritoneum. It extended far up under the ribs, and the lower pole reached far down toward the pelvis. No attempt was made to deliver the organ, as this was not necessary, and could not have been done without first having opened and drained it. No attempt was made to control hemorrhage by compressing the pedicle, as there was such tremendous distention of the organ as to make hemorrhage unlikely. A large trocar was first introduced, urine mixed with pus spurting out with great force. The opening was then rapidly enlarged by stretching and the cavity explored by the finger. No stone could be felt, but the cavity was so large that the exploring finger could not easily reach all parts of it. The secreting substance of the kidney was reduced to a mere shell of parenchyma less than one centimetre thick. After thoroughly washing out the cavity, a large drainage tube was inserted for drainage and the wound closed. Very little chloroform was used and the patient reacted well.

During the first twenty-four hours 109 ounces of urine drained through the tube. The tube slipped out of the kidney wound and was removed at the end of twenty-four hours. During the second day 147 ounces of urine was voided naturally, while 128 ounces passed the third day. Practically no urine escaped into the dressings, due, no doubt, to the collapsing of the distended kidney and the shutting off of the nephrotomy wound. Recovery from the operation was rapid. The patient walked out of the hospital on the twenty-third day.

On March 10, twelve days after the operation, he stated that the stone which he had felt in the bladder before the operation had passed into the urethra and was being forced out with each urination. A stone about an inch long could be felt in the perineal urethra. Attempts to milk it forward were unsuccessful, but it was slowly forced out by the urine until it finally caught at the fossa and was removed by the patient himself with a pair of thumb forceps. This stone was pure white, very soft, breaking

up on the slightest pressure, and was little more than a mass of phosphatic sand, loosely adhering and moulded into the form of a calculus by the urethra.

Two days after leaving the hospital, another stone became impacted in the prostatic urethra, and was so effectually blocking the channel as to prevent the escape of urine. This was readily pushed back into the bladder with a Porges catheter and a large amount of residual urine withdrawn. This stone was later crushed at the office under cocaine anæsthesia and the fragments completely removed at the first sitting.

His present condition is good. He is going about attending to his practice, feels well, is voiding a large amount of urine, and looks the picture of health. The urine is pale, turbid with pus, acid, specific gravity 1006, and contains more albumin than can be accounted for by the pus present. Indigo carmine is eliminated in exactly fifteen minutes, coloring the urine a deep blue. Twenty minims of 1 per cent. solution of phloridzin were injected. A positive test for sugar was obtained in fifteen minutes. The urea is low in the single specimen voided at the office.

Summary.—Our patient gives a history of calculous diseases of fifteen years' duration. The onset was marked by symptoms referable to the kidney. He has passed a great many calculi. Perineal section was performed for an impacted calculus in the urethra. Another stone was removed from the urethra by milking it forward to the meatus. Two litholapaxies were performed. The left kidney was removed on account of calculous pyonephrosis. Empyema of the left ureter developed as a result of the presence of a calculus, which was demonstrated in the first X-ray examination. This calculus was forgotten and consequently overlooked at the time of the left nephrectomy. Infection of the right kidney took place, pyonephrosis developed, and complete anuria occurred suddenly three years later. Anuria was complete for three days, and was due to the plugging of the ureter with pus. Renal retention was partially relieved by massage of the kidney and along the ureter, thus dislodging the plug of pus filling the ureter. Anuria again developed and nephrotomy of the remaining kidney was done. This kidney was greatly distended with urine and pus. No stone was demonstrated by the X-ray and none found at the operation. The parenchyma formed a mere shell of tissue less than one centimetre thick. Recovery

was prompt and complete. Since the operation the patient has passed one stone and another has been removed from the bladder by litholapaxy. The X-ray plate now shows a stone in the left ureter of the same shape, size, and location as shown in the plate taken three years ago. Normal peristalsis was observed in this ureter three years after the complete removal of the corresponding kidney.

REMARKS.—Infection of the ureter as a sequence of kidney infection is common. Removal of the diseased kidney is followed, in the majority of cases, by the disappearance of the diseased condition in the ureter. Empyema of the ureter following nephrectomy, is, therefore, rare, but does occur, and is usually due to a stone in the ureter, as in our case. Israel reports a case of empyema of the ureter following nephrectomy, and states that he has seen this complication only four times in 900 cases of total extirpation of the kidney. In his case a stone, which was overlooked at the first operation, was present in the vesical end of the ureter.

The persistence of peristalsis in a ureter following a complete nephrectomy must also be extremely rare. I have seen no observation of this kind reported in the literature. In Israel's case above referred to, the diagnosis was made by the cystoscopic picture, pus escaping from the ureteral opening. The report does not state, however, whether the escape was continuous or intermittent. While it is probably true that, under normal conditions, the presence of urine in the ureter is necessary to excite peristaltic contractions, it would seem to be equally true from our single observation, that the presence of a foreign body is sufficient to excite contractions similar in type to those seen under normal conditions, even after the removal of the corresponding kidney. One is hardly justified in drawing conclusions from a single observation, but it would seem that under certain pathological conditions, at least, peristalsis does take place independent of any stimulus derived from the kidney, and that, therefore, the ability to contract lies in the ureter itself, whatever its cause may be. Incidentally

we find a hint as to the necessity for the removal or destruction of the mucous membrane of the ureter after the removal of the kidney where the ureter is badly infected. Such a ureter, if not properly dealt with, may continue to harbor infection and furnish a focus from which the other kidney may become infected.

Reports of operations upon a single kidney, in the absence of the other, as a result either of a congenital defect or of disease, are scattered through the literature. The number of such cases, however, is not large, and in the greater number the operation was undertaken for calculous disease. The risk of surgical interference, which is always great because of the absence of the second kidney, depends further upon the nature and extent of the disease for which the operation is to be done. Where only slight damage to the secreting substance has occurred, and the patient is otherwise in good condition, there is no reason why operation should not be undertaken for the relief of distressing symptoms, especially where other means have failed. This is particularly true of calculous disease, where simple nephrotomy can be rapidly performed. It is to be borne in mind, however, that nephrotomy for calculus, even in the simplest case, may be followed by secondary hemorrhage, blood escaping either externally through the wound or internally into the bladder. The cause of hemorrhage in these cases we do not understand. The possibility of such a complication makes one hesitate in advising operation under such circumstances.

In most cases, however, surgical interference becomes imperative, either to relieve conditions which have become unbearable, or to save the patient's life, and no choice is left. The results obtained under these circumstances, even where the kidney is extensively diseased, are astonishing. It is surprising what a small amount of kidney substance suffices to do the work usually performed by two organs, and illustrates in a striking way the enormous reserve functional capacity of the kidneys. In our case, much of the secreting substance had

been destroyed and the remaining shell of parenchyma subjected to great pressure and distention, but as soon as the pressure was relieved, the remaining tissue quickly responded and excreted more than a hundred ounces during the first twenty-four hours, and nearly 150 ounces during the next day.

A case reported by Rosenstein is interesting in this connection. A young woman had had the right kidney removed for calculous disease. One and a half years later she complained of pain in the left kidney, and severe headache. The urine was cloudy with pus, and examination revealed a stone in the remaining kidney. Operation was postponed for two years, hoping it might be avoided. Finally the patient demanded an operation for relief of her intolerable suffering. The kidney was scarcely as large as a normal organ, the parenchyma was so thinned that the stones were not only felt but actually seen through the thinned kidney substance. Thirty-two stones were removed by opening widely all the calices. The patient, though desperately ill for a few days, made an excellent recovery. To add further interest to the case the stones were found to be pure cystin.

The only report I have noted in the literature of the last few years dealing particularly with operations upon a single kidney is that of Nicolich, of Trieste, who reports four very interesting personal cases.

THE CONTROL OF URINARY DRAINAGE AFTER CYSTOTOMY.

BY H. H. SINCLAIR, M.D., C.M.,

OF WALKERTON, ONT.

DURING the past six years there has been a steady endeavor on my part to decrease the discomforts following prostatectomy.

After the waste of much time and energy in contriving complicated apparatus, the following simple method has been found to meet all requirements:

Dental rubber dam is gummed to the skin by means of a cement made of dental crown rubber dissolved in xylol. This makes a strong non-irritant material which sets rapidly.

When the cement is fast, the rubber dam is folded to form a flat tube, which will convey the discharges to any convenient receptacle. The most convenient receptacle I have found for this purpose in prostate cases consists of a rubber glove stretched over an ordinary hard rubber pessary which has been molded to the surface to be drained. This is held in place by means of a sling of rubber tubing attached to a belt. Into the mouth of the glove the folded rubber dam is inserted. This is light and cleanly, and permits free movement. When one glove is in use the mate can be kept in an antiseptic solution to be ready when a change is required. Practice soon makes one expert with the method, and as this is acquired its range of usefulness extends greatly.

The formula is as follows: Take a sheet of crown dental rubber, cut in small pieces, drop these into a bottle, and cover with xylol. (I use a broad-mouthed glass-stoppered bottle, and if done in the evening the cement is ready for use in the morning.) Now cork the bottle and leave it alone.

When I wish to use it I decant the thin portion on top, and fill the barrel of an ordinary glass syringe (from the butt

end) with the heavy thick portion at the bottom, as this will dry very quickly and is very strong. By inserting the piston one has a container which gives full control of the material. This can be expressed where and when it is required. The thicker the cement the quicker it dries. The method of use is as follows:

Temporarily pack the mouth of the drainage wound with gauze (to keep dry). Wash skin external to the wound with pure xylol, dry with gauze, run a broad ring of cement entirely around the wound well external to it.

Now take a strip of rubber dam and stretch firmly over the surface covered by cement and necessarily the wound. Keep fairly stretched or the contraction of the cement will cause the rubber dam to wrinkle and bulge away from the skin. When firmly adherent (two to five minutes), trim out the portion in the centre with a scissors curved on the flat. A heavy roller such as used for mounting photos is found very useful for getting a smooth, even surface.

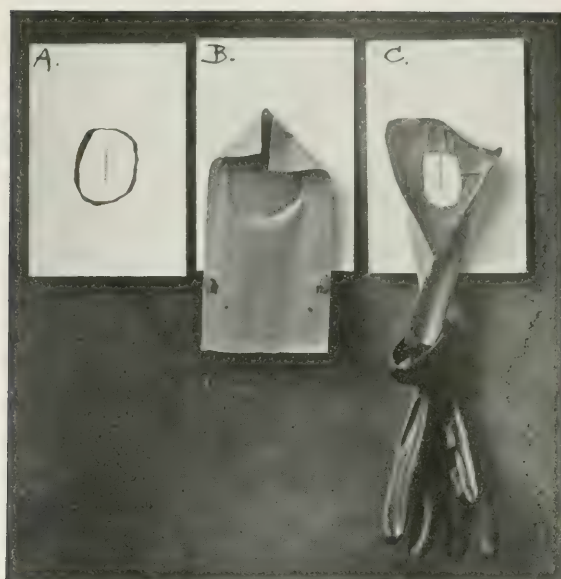
The drainage can now be thoroughly controlled; by simply folding the edges of the sheet, discharges are directed to any desired spot.

I have used pure para rubber (washed, dried, and ground); it answers the purpose but the crown rubber is more generally obtainable and is stronger. Every dentist has crown rubber and rubber dam, whilst we all have xylol in our microscopic supplies. I may say that I have used more pessaries during the past year than for a long time previous.

This method has eased my patients and made a great saving in the amount of gauze, cotton, and laundry required for them. If it stands the test of time, it must effect a tremendous saving in these items in the larger hospitals. As a test a square of rubber dam 5 in. by 5 in. (cemented to the skin of the abdomen), has been worn for three weeks without the slightest inconvenience or discomfort. When it is desired the dam can be removed, the cement washed off with xylol, and a new piece applied as before.

This method has been found useful in mastoid, biliary, and

FIG. 1.



Rubber dam as used for urinary drainage after cystotomy.

FIG. 2.



Materials assembled for making urinary rubber conduit. 1, crown rubber; 2, cement container; 3, rubber dam; 4, syringe; 5, roller; 6, pessary.

other cases requiring drainage.¹ It will be found especially useful in compound fractures, which have been put up in plaster, as the rubber dam prevents discharges running between the plaster and the skin inside the cast. Whenever the drainage area permits I roll the dam on a heavy glass roller and run it firmly over the surface. This is the best method where possible.

Gauze is placed between the rubber dam and the skin external to the line of cement to prevent sweating.

NOTE.—By the courtesy of Messrs. Johnson and Johnson I was recently furnished with some of their zinc oxide rubber mass as used for making adhesive plaster, which I find when treated with xylol in the same manner as the crown rubber is even more satisfactory. A small quantity of this could be obtained by dissolving the facing of zinc oxide plaster in xylol.

¹ The Treatment of Compound Fractures, E. H. Ochsner, B.S., M.D., Medicine, Detroit, June, 1906.

THE TECHNIC OF MEDIAN PERINEAL PROSTATECTOMY.*

BY SAMUEL ALEXANDER, M.D.,

OF NEW YORK,

Surgeon to Bellevue Hospital.

EVER since 1887, when the late Mr. McGill, of Leeds, demonstrated the possibility of enucleating the enlarged prostate from its fibrous sheath through a suprapubic cystotomy, the thought and ingenuity of many surgeons have been directed to perfect this procedure, either by modifications and improvements upon McGill's method, or by surgically approaching the prostate by incisions through the perineum.

At the present time there are three well-recognized operative procedures for the removal of the obstruction caused by the enlarged prostate. These are, first, by suprapubic cystotomy and intracapsular enucleation; second, by median perineal urethrectomy and intracapsular enucleation; third, by a perineal incision, which exposes the posterior surface of the prostate and transcapsular enucleation. Each of these methods has its advocates. All of these methods have been modified and improved from time to time.

The controversies concerning operations upon the prostate which have arisen during recent years have been marked often with an undue personal animus which is to be regretted. These controversies have usually been upon minor points of technic and upon questions of priority, and too often the essential question, namely, the anatomical and surgical basis of the operations, has been overlooked or ignored. All of these operations are frequently performed successfully, but it would be an error to claim that any one of them is a perfect operation which can be performed by every surgeon with uniform success. The last word upon the technic of

* Read before the Philadelphia Academy of Surgery, Nov. 7, 1910.

prostatectomy certainly has not been spoken, nor will it be until there is a more wide-spread and a better practical knowledge of the various pathological and anatomical changes which occur as the result of prostatic enlargement. There are, however, certain anatomical facts which can be clearly demonstrated, and these form the basis of any operation which has for its object the enucleation of the portions of the enlarged prostate which cause obstruction to urination, whether the operation be performed through a suprapubic cystotomy or by either of the perineal procedures.

In the present paper I shall call attention to what I regard as the most important of these anatomical facts, and I shall endeavor to point out their practical significance to the surgeon who performs this operation.

I. WHAT PORTIONS OF THE PROSTATE CAUSE OBSTRUCTION TO URINATION.

It may be positively stated that the portions of the prostate which cause obstruction to urination by their enlargement, whether this obstruction be mechanical or physiological, are those portions which lie upon the sides of the urethra and anterior to the seminal ducts. These are (1) the lateral lobes, and (2) the middle isthmus or middle lobe (when this latter exists). The portion of the prostate which lies behind the urethra and posterior to the seminal ducts does not cause obstruction. This portion I shall call (although perhaps not properly) the posterior isthmus of the lateral lobes.

The Line of Cleavage.—These two portions of the prostate, namely, the lateral lobes and the posterior isthmus of the lateral lobes, are separated from each other by a distinct line of cleavage. This line of cleavage is formed by a series of fibrous bands which radiate outward from a central nucleus, behind the urethra, and these bands pass outward and forward to join the sheath of the prostate. The shape and direction of this line of cleavage give to the posterior isthmus of the lateral lobes a more or less crescentic shape, with the

concavity directed forward. This posterior isthmus of the lateral lobes must become enlarged, but it never causes obstruction to urination. It is not necessary to remove it by prostatectomy, and it cannot be enucleated from the prostatic sheath. It is therefore an error, and not in accord with the facts of anatomy, to say that the entire prostate is removed by any of these prostatectomy operations.

The lateral lobes of the prostate which lie on either side of the urethra, and which, by their enlargement, cause obstruction to urination, are anterior to this line of cleavage. These lobes can be easily enucleated from the sheath of the prostate if the line of cleavage be followed. These lateral lobes in the prostate are loosely attached to the sheath of the prostate. The line of cleavage has a constant anatomical position; the relation of the line of cleavage to the urethra is always the same. This can be shown by a transverse section made through the enlarged prostate at right angles to the urethra. The line of cleavage always begins *posteriorly*, on the level with the floor of the urethra, and extends outward and forward so as to partially surround each of the lateral lobes. If, therefore, the urethral mucous membrane be torn through by the finger at the level of the floor of the prostatic urethra, the line of cleavage will be opened and the lateral lobes can be easily separated from the sheath of the prostate.

II. THE RELATION OF THE BASE OF THE PROSTATE TO THE BLADDER.

Normally, the muscular fibres of the bladder are attached to the upper part or base of the lateral lobes of the prostate. The base of these lobes is not enveloped by the fibrous sheath of the prostate. It is covered by the mucous coat of the bladder. This coat is rather loosely attached and may be easily pushed off from the base of the prostate by digital dissection.

The Anatomical Middle Lobe.—The lateral lobes of the

prostate are joined together by a wedge-shaped band of prostatic tissue, which varies in quantity in different individuals, and which runs behind the urethra and in front of the seminal ducts. This is known as the anatomical middle isthmus or middle lobe. When this band becomes enlarged, it arrests the finger during the enucleation of the lateral lobes from within the sheath. This middle isthmus, however, can be broken through at its junction with either lateral lobe by the finger. When the prostate is separated from its sheath by following the line of cleavage and the middle isthmus is broken at its junction with either lateral lobe, the latter is suspended within the sheath of the prostate only by the attachment of the mucous membrane of the urethra. This mucous membrane is easily torn through by the finger, and the enucleated lateral lobe then lies free within the prostatic sheath and may be extracted through the external wound by forceps. The enucleation of the lateral lobes is comparatively easy if the facts just mentioned are known and their practical value appreciated.

The enucleation of the middle lobe or middle isthmus, when this is enlarged and causes obstruction, is a little more difficult. The presence of a so-called middle lobe is not a constant factor in prostatic enlargement, and when there is present a so-called middle lobe enlargement, the condition is not always the same either morphologically or anatomically. I think it necessary, therefore, to call attention to certain anatomical facts, the importance of which does not seem to be appreciated by some writers upon this subject.

Some years ago I called attention to the fact that the so-called middle lobe enlargement which projects in some cases intravesically between the two lateral lobes is not always anatomically the same; it may be due either, first, to enlargement of accessory glands, which are situated in some cases just beneath the mucous membrane on the posterior side of the internal urethral orifice; or second, it may be due to enlargement of these glands, plus an enlargement of the anatomical median isthmus; or third, it may be due to

enlargement of the anatomical median isthmus alone. The importance of the enlargement of these accessory glands in this situation is that they push upward the muscular fibres beneath the trigone and thus interfere with the opening of the urethra at the time of urination. The real anatomical isthmus, when this is enlarged alone, can be removed or enucleated with the lateral lobe, which is last removed, by passing the finger beneath it and by stripping it off from its connection with the mucous membrane of the bladder. The enlargement of the accessory glands alone cannot be enucleated without tearing the mucous membrane on the posterior lip of the vesical outlet.

Since 1895, in nearly all cases, I have been doing a median perineal operation, which I shall now describe.

Preparation of the Patient for Operation.—As a rule, no special preparation is necessary. I think it is inadvisable to change in any important particular the habits of an old man, and therefore, unless there is some evidence of kidney insufficiency, I operate without any previous preparation, except that it is customary to give the day before operation a dose of castor-oil, and to follow this with a simple enema. It is best when possible to operate early in the morning, so as to insure for the patient a good night following the day of operation. The operative field of the perineum is prepared by shaving the surface and by washing with green soap and water. No antiseptic is used. The perineum is then covered with dry gauze and a towel. In anæsthetizing, nitrous oxide gas, followed by ether, is employed. The patient is put in a position of lateral lithotomy, the buttocks overhanging the edge of the table. It is not desirable to make this position extreme by over-flexion of the thighs upon the abdomen. The operating table should be high, so that the perineum will be on a level with the chin of the operator as he sits at the foot of the table. A lithotomy staff with a deep median groove is passed into the bladder. This is then given to an assistant who stands on the patient's left and who holds the staff steadily on the median line. The perineum is divided in the middle line by

an incision of about two inches in length, which terminates behind at a point about three-quarters of an inch in front of the anterior margin of the anus. The skin, the superficial fascia, and Colles's fascia are divided. Buck's fascia covering the accelerator urinæ muscle is not divided. The membranous urethra is divided by thrusting a sharp-pointed straight bistoury into the groove of the staff just behind the bulb of the urethra, and cutting forward the floor of the urethra and the lower border of the triangular ligament; a grooved director is then passed in until its point enters the groove of the staff. It is then gently pushed forward through the prostatic urethra and into the bladder, and the staff is withdrawn. The groove of the director is turned backward, and along this the bistoury is guided with the cutting edge directed backward, and the membranous urethra thoroughly divided up to the apex of the prostate. It is of the utmost importance that this division of the floor of the membranous urethra should be thoroughly done, and for this purpose a very sharp knife should be used so as not to lacerate the compressor urethræ muscle. The operator, holding the director in his left hand, introduces the forefinger of his right hand into the wound, and, keeping close to the groove of the director, pushes the finger forward until its tip has passed into the prostatic urethra. The director is then withdrawn, and the finger is advanced with a slight rotary motion through the prostatic urethra, thus dilating this portion of the canal. There is usually very little bleeding up to this point. In cases in which the prostate is not greatly enlarged, the finger can be passed through the prostatic urethra so that its tip will enter the bladder. In cases of marked lateral enlargement, it is sometimes impossible to force the finger entirely through the prostatic urethra.

The second step in the operation, namely, enucleation of the lateral lobes, is now begun. In order to proceed in a systematic manner, I always remove the obstruction from the side which is the larger, but when the two lateral lobes are of about equal size, I remove the right side first. The fore-

finger of the right hand is turned with the nail towards the floor of the urethra. The mucous membrane on the side of the urethra is torn through with the tip of the finger at a level with the urethra floor, and the line of cleavage is entered. As soon as the mucous membrane is torn, the finger, following the line of cleavage between the enlarged lateral lobe and the portion of the prostate lying behind it and the sheath, separates the one from the other by a sweeping movement outwards and forward. At the same time the tip of the finger is pushed upward toward the bladder wall. The pulp of the finger should be turned towards the prostatic capsule, and the nail should be kept closely to the outer side of the lateral lobe which is being enucleated. The finger should not pass beyond the middle line either in front of or behind the urethra, for it is perfectly easy to separate one lateral lobe from the other. When the side and posterior surface of one lobe have been freed from within the sheath, the base of the lobe which is attached to the bladder wall can be separated from the latter by hooking the finger above its upper margin, and by a sawing motion this can be easily peeled from the bladder wall without injury to the mucous membrane of the latter. When this has been done, the junction of the lateral lobe with the middle isthmus is torn through by the finger. The mucous membrane along the upper surface of the lobe is now torn through, and the enucleated mass can be picked out from within the capsule by a small pair of lithotomy forceps. These should be tightly closed in delivering the enucleated mass, so as not to unduly stretch the opening which has been made in the floor of the membranous urethra.

The same procedure is now followed on the opposite side, and in a case in which there is only lateral lobe enlargement, this completes the enucleation. In cases in which there is very marked enlargement of the lateral lobes, so that the tip of the finger cannot be passed through the prostatic urethra and into the vesical orifice, the enucleation may be begun in the manner above described, and the lateral lobe separated from

the prostatic sheath; but it may be necessary, in order to separate the lobe from its attachment to the bladder, to seize the lobe with forceps and draw it towards the perineum and over towards the opposite side. The forceps are held with one hand, and a gentle traction is made; the forefinger of the other hand is passed between the mass to be removed and the capsule of the prostate, and is hooked over the upper margin of the lateral lobe, which is then to be stripped off from the mucous membrane of the bladder.

When the lateral lobes have been removed and the line of cleavage closely followed, little injury will have been done to the prostatic plexus of veins which run through the sheath of the prostate, and therefore the bleeding will be inconsiderable. After the right lobe has been removed, it will be found that in separating the left lobe the working space within the capsule is increased and the enucleation of the second lobe is much easier. In cases in which there is obstruction on the floor of the urethra at the vesical orifice (so-called middle lobe enlargement), this is to be removed after the lateral lobes have been enucleated. In most cases the middle lobe can be enucleated with one of the lateral lobes, preferably that which is taken out last. This is done by simply separating it with the finger from beneath the lower lip of the urethral orifice. When this cannot be done, the middle lobe can be seized just beneath the mucous membrane of the bladder by forceps passed along the finger and separated from it.

The middle lobe, when enlarged, is sometimes quite difficult to remove because of its firm attachment to the bladder. If, however, the forefinger of the right hand be passed up into the space which was occupied by the left lobe, there is not much difficulty in pushing the middle lobe over to the right side and separating it from the bladder and the urethral mucous membrane. To facilitate this it may be caught with forceps and pulled down toward the perineum. In some cases the middle lobe consists simply of a soft tab of raised mucous membrane with the enlarged accessory glands. These cannot

be enucleated without tearing the mucous membrane, and in such a case I usually catch the tab with forceps, draw it down towards the perineum and cut it off cleanly with scissors in the same way in which the uvula is shortened. I have done this a number of times; the part cut off consists only of dilated glands and mucous membrane, and the cutting does not destroy the muscular fibres of the bladder.

At the completion of the operation of enucleation, the vesical outlet is felt as a soft ring which fits loosely the end of the forefinger. The floor of the bladder is level with the urethra. The mucous membrane about the vesical orifice is intact on all sides, and in case of enlargement limited to the lateral lobes, the mucous membrane upon the floor of the urethra, including the verumontanum, may be and usually is preserved. The cavities from which the lateral lobes have been removed are quite smooth. The position and shape of the prostatic urethra are preserved in a very remarkable degree by the contraction of the prostatic sheath and by the action of the levator ani muscles.

Changes in method are required in certain cases. When the prostatic lateral tumors are very large and consist of irregularly shaped masses each of which seems to be surrounded by its own capsule, it may be advisable to remove the lateral tumors from each side in two or three parts and not *en masse*, so as not to over-stretch the urethra or lacerate the compressor urethræ muscle. The line of cleavage between the tumors can be felt and they can be separated from each other and from the mucous membrane or bladder wall, and removed separately.

When it is necessary to do this some part of the lateral lobe may be overlooked and not removed. This is especially likely to occur about the vesical orifice. It should therefore be a rule that the operation is not considered complete until the mucous surface of the latter is felt to be smooth and even, the tissues pliable, and the orifice dilatable and its floor level with that of the bladder.

In cases of long-standing prostatic disease in which the

fibrous changes are marked in both the prostate and bladder wall, the enucleation of the obstructive masses is more difficult because of the firm attachment of these to the capsule and bladder wall by strong bands of fibrous tissue, which are difficult to break with the finger, and it is sometimes necessary to catch the obstructing mass with forceps and to divide the bands with scissors passed into the wound under the guidance of the finger.

The Control of Hemorrhage.—The operation of enucleation of the obstructing portions of the prostate being completed, the control of hemorrhage demands attention. I have found that when the neck of the bladder is drawn down toward the perineum after removal of the obstruction, the veins of the prostatic plexus are compressed and the hemorrhage ceases immediately. I therefore have adopted the following method to accomplish this: The tip of the forefinger of the left hand is introduced through the wound into the bladder, and is hooked over the lower lip of the vesical orifice. Along this finger is passed a pair of flat volsellum forceps, and with these the lower lip of the vesical orifice is grasped; the forefinger is withdrawn and slight traction made upon the forceps. The hemorrhage at once stops.

Bladder Drainage.—A metal tube is then introduced into the bladder and the bladder irrigated with hot water to remove all clots. The metal tube is removed and a large rubber catheter, No. 32 F, is passed into the bladder in front of the forceps. This should be accurately placed so that the eye of the catheter is just within the urethral orifice. Adequate drainage of the bladder depends upon the proper adjustment of this tube.

Wound Dressing.—An assistant holds this tube in place, while the surgeon packs with gauze the cavities left by enucleation of the lateral lobes. This packing should be made of iodoform gauze one inch wide. This is passed by long forceps alongside of the tube, and during its introduction gentle traction is made upon the forceps which hold the vesical outlet.

The ends of the gauze packing hang out of the wound. After the packing is in place the drainage tube is tested, and is then secured by pinning it to the skin with a safety pin. The dressing is then applied. This consists of a pad of gauze which is slipped between the skin and the safety pin,—two or three pads of folded gauze on either side of the tube and two pads of cotton and gauze. These are to be held in place by a special 3-tailed T bandage. During the dressing the surgeon makes gentle traction upon the forceps to prevent the bladder from slipping upwards and causing bleeding. The tube is then tested again and the patient put to bed. The forceps holding the bladder are then removed, and a simple siphon tube is attached to the bladder tube by a glass connection. The siphonage tube should be passed under the patient's knee and the free end dropped into a large bottle placed at the bedside, containing six or eight ounces of a 1:5000 bichloride solution. The siphon is secured by a pin to the draw sheet of the edge of the bed. When siphonage has been established the glass tube will be full of fluid, but if the drainage stops the tube will be empty. The tube may be full and yet drainage may be defective if a clot of blood plugs up the eye; when this occurs there will be leakage along the tube and soiling of the perineal dressing, and there will be associated with this pain at the end of the penis and a painful desire to pass water. The efficiency of the drainage and the comfort of the patient after operation depend upon the care with which the drainage tube is placed and secured. If the siphonage tube is too long it causes pain by sucking the bladder wall into the eye of the tube. When the drainage tube is properly adjusted and secured and the dressing evenly and artfully applied, the patient has no pain and rarely needs an anodyne. With this mode of dressing and drainage the patient may lie upon his back or upon his side (the side opposite to that on which the siphonage bottle and tube are placed), but the position of these may be changed from time to time to suit the wishes of the patient and to permit of his freer movements.

The Post-operative Management.—The management of

cases after prostatectomy is of as much importance to secure a successful result as the operation. A skilfully performed operation may fail by unskilful nursing or failure to attend to the necessary details, but I now expect to have prostatectomy operations follow much the same course as simple perineal sections.

General Treatment.—For the first two or three days I give a light diet of eggs, cereals, milk, broth, tea, toast, and as much water as the patient can be made to take. If the drainage is perfect there will be little leakage about the tube, but if the prostate removed has been large there may be some leakage along its sides by the capillary action of the gauze strips, which will necessitate the changing of the outside dressing. If there is no pain and no clogging of the tube by retained clots the tube should be gently washed out once or twice to keep it clear and to remove pus in cases of cystitis. In some cases a pillow placed under the patient's knees will give relief to the backache due to the dorsal position. If the drainage is perfect and the patient comfortable, this is the plan to follow for 24 hours. A cathartic is given at the end of 24 hours. I then make the first change of dressing. The tube is removed and the gauze packing is taken out of the wound and the urethra flushed out with saline solution. After removing the gauze there is sometimes free oozing of blood, but this stops in a few minutes. A little iodoform gauze or gauze soaked in a 2 per cent. protargol solution is placed between the edges of the wound so as to separate them. I then apply over the perineum a cotton gauze dressing in the form of pads secured by the 3-tailed T bandage. These are changed every two to three hours.

After removing the tube there is usually almost complete urinary incontinence for two or three days. This is because the patient cannot control his over-stretched and atonic sphincter. But control is soon gained and he then passes voluntarily at first through the wound. The discharge of urine through the urethra usually begins about a week after operation. The dressing of the perineum should be changed

as often as necessary to keep it dry, and the wound should be washed by a flow of water injected into it from a syringe to wash away any urine; the skin about the anus and wound should be powdered with talcum. The wound is subsequently inspected twice a day and is made to heal from the bottom. The edges of the wound should be wiped with cotton every day to prevent the growth of epithelium into it.

It is not my custom to pass any sound through the urethra for several weeks after operation. The bladder for the first three days is washed out by passing a catheter through the perineal wound. After this time, if it is necessary to wash out the bladder on account of a cystitis, a catheter a coudé can be easily passed through the urethra.

The Control of Urination and the Return of Vesical Power.—It is not to be expected that the patient's control over urination should be immediately and perfectly re-established, when we consider that the operation has disturbed the relation of the sphincters and caused them to become atonic by stretching, but it is surprising how quickly this control returns, although sometimes after the operation the calls to urinate, if not heeded, will be followed by involuntary escape of urine. But as soon as the wound has healed and the tissues which have been cut and disturbed have consolidated, the power of retaining and expelling urine voluntarily is perfect. In most cases now this can be expected in six or eight weeks, but in many this result is obtained much earlier.

The return of vesical function, no matter how atonic may have been the bladder, is to be confidently expected, provided there remain no obstruction to urination and there be no incurable cystitis. As a rule the bladder is free of cystitis by the time the perineal wound is healed. Its expulsive power gradually improves, and there is only to be noted that the capacity may be lessened, owing to the weakening of the muscle at the vesical outlet which permits a little urine to escape into the urethra before the former capacity of the bladder is exceeded. On this account we find that the intervals of urination after operation may be four instead of six

or eight hours, and the patient may have to get up once or twice even during the night. This condition improves with time, but should be understood. The cystitis in any case will get well under washing and local injection, if the bladder is not sacculated and if there is no obstruction to urination.

ADVANTAGES OF THIS OPERATION.

1. It is a clearly defined surgical procedure which has a rational anatomical basis.
2. It can be very rapidly performed by a practised hand, the operation lasting rarely more than five minutes and the patient being not more than 15 or 20 minutes upon the operating table.
3. The hemorrhage can be quickly and effectually stopped.
4. The drainage of the bladder is simple, and need not be maintained after the first 24 hours.
5. The patients are spared the discomforts of continuous drainage and irrigation.
6. The comfort of the patient is much greater than after any other form of prostatectomy.
7. The functional results are very satisfactory.

AN OPERATION FOR STIFFENING THE KNEE-JOINT.*

WITH REPORT OF CASES FROM THE SERVICE OF THE NEW YORK
ORTHOPÆDIC HOSPITAL.

BY RUSSELL A. HIBBS, M.D.,

OF NEW YORK,

Surgeon-in-Chief of the New York Orthopædic Hospital and Dispensary.

THE operation of stiffening joints has been done very generally during the past few years in cases of infantile paralysis, especially in the joints of the foot and ankle when the permanent damage to muscle and ligamentous structure has been such as to make necessary the indefinite use of apparatus to prevent deformity and secure function.

The knee-joint, however, I do not believe has been stiffened frequently enough, especially among the classes of people we see in the dispensaries, who are, in most instances, wage earners, and the necessity of wearing some form of brace permanently is troublesome and expensive to them.

This is probably due to the fact that attempting to stiffen this joint by the old method of doing practically an excision has not been very successful. In the first place the removal of a sufficient amount of cartilage from the femur and tibia to secure bony surfaces for approximation shortens the leg about $1\frac{1}{2}$ inches, which, with the shortening already present in these cases, is a serious consideration. And in the second place, the removal of the ligaments makes difficult the prevention of deformity during the long period, a year or more, before there is solid bony union.

This led me on January 15, 1909, to perform an operation which obviates these disadvantages. It was that of mortising the patella, after it was denuded of its periosteum and car-

* Read before the Orthopædic Section of the New York Academy of Medicine, October 21, 1910.

tilage, into a space prepared for it by the removal of the cartilage, just anterior to the centre of the tibia and femur. It will be found that such a space may be secured without injury to the crucial ligaments or to the epiphysis of either bone. With the patella in this position, a perfect bony bridge is thus formed between the tibia and the femur.

There was some question in my mind as to the nutrition of this bone in its new position, so that in the first few cases the upper attachment of the patella ligament and periosteum was left intact, in order to leave undisturbed the subperiosteal vessels. Later this precaution was considered unnecessary and was discontinued. The patella in the first three cases was put in transversely, and in the next four, horizontally. In all these cases, in from five to six months there was solid bony ankylosis, which has been maintained a sufficient length of time since the removal of support to consider it permanent.

(The first case, with a description of the operation, was reported to the Boston Orthopædic Club, March 24, 1909.)

It then occurred to me that if the patella was placed horizontally in a space prepared for it, and then if the periosteum was carefully preserved in its removal from the patella and brought down over the freshened area and stitched to the periosteum around the edges of the tibia and femur, there would be reproduced from this periosteum new bone, so that our bony bridge would be larger and stronger.

In the last three cases this procedure has been adopted, as shown in Figs. 1, 2, and 3, and in each case there has been a reproduction of bone from this periosteum, as has been unmistakably shown by X-ray pictures. The advantages of this latter procedure are obvious. In the first place there is less likelihood of the patella slipping out of its bed, and in the second place there is secured, through the reproduction of new bone, a larger and stronger bony bridge, and the weight may be safely borne on the leg earlier with advantage, and all support removed sooner.

These cases have walked in plaster at the end of from four to six weeks, and all support has been removed at the end

of the fifth to the seventh month. Except in the three last cases, all support was removed at the end of the fourth month.

It is important to note what an adequate bony bridge the patella makes, and, in addition, how far beyond the edges of the patella (Fig. 3) the periosteum extends when stitched to the periosteum of the femur and tibia, which measures the extent of the new bone produced. This operation would seem to be an ideal one in such cases as are here reported, and in addition it would seem helpful in excision cases for disease of the knee-joint when the patella is healthy, to utilize it and its periosteum in this way as a bridge between the two bones.

The operation in all these cases has been done through a transverse incision just below the patella. The periosteal and skin sutures were of ten-day chromic catgut. The wound was closed without drainage and a plaster spica applied. The wound was dressed through a window on the tenth day, and in every case found to be completely healed. The ages of these patients have been from thirteen to seventeen years. I believe, however, that younger children could be operated on with equally good results.

CASE I.—Ethel H., age thirteen years. Infantile paralysis. Loss of control of right knee.

Operation.—January 15, 1909, patella mortised into the joint transversely. Ligaments unimpaired. Wound closed without drainage. Plaster spica applied. Walked in plaster after ten weeks, and in six months all support removed. Result, complete bony ankylosis.

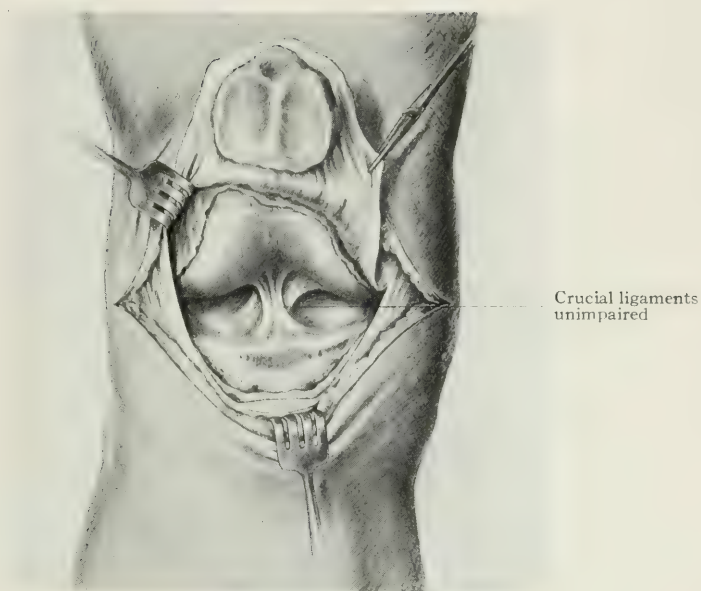
CASE II.—Mary H., age fifteen years. Infantile paralysis. Loss of control of right knee.

Operation.—March 1, 1909; walked in plaster April 19, 1909. Walked without support in 5½ months. Result, complete bony ankylosis.

CASE III.—Kenneth W., age fourteen years. Infantile paralysis. Loss of control of left knee.

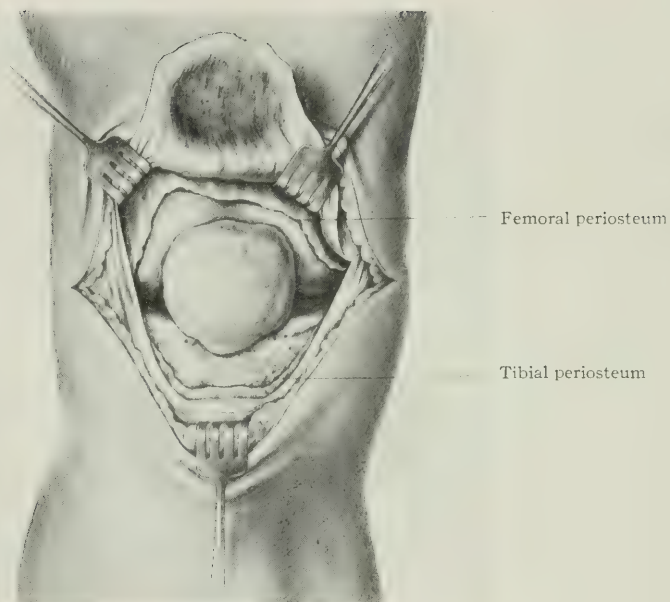
Operation.—April 30, 1909; walked in plaster June 30, 1909. In seven months walked without support. Result, complete bony ankylosis.

FIG. 1.



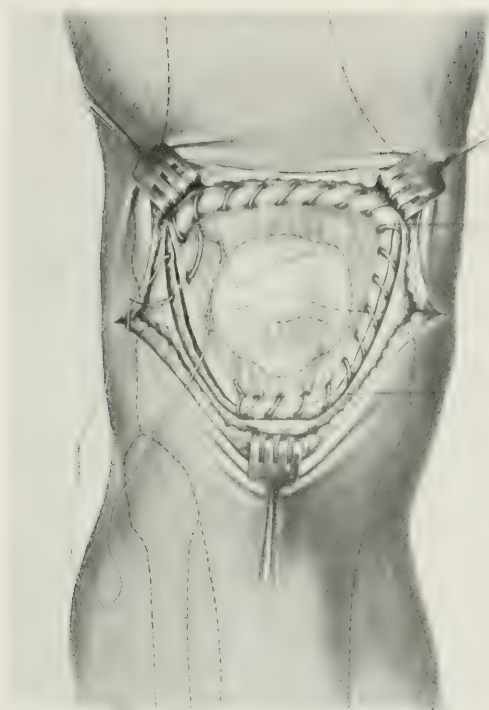
Shows space on the femur and the tibia prepared to receive the patella.

FIG. 2.



Patella in place.

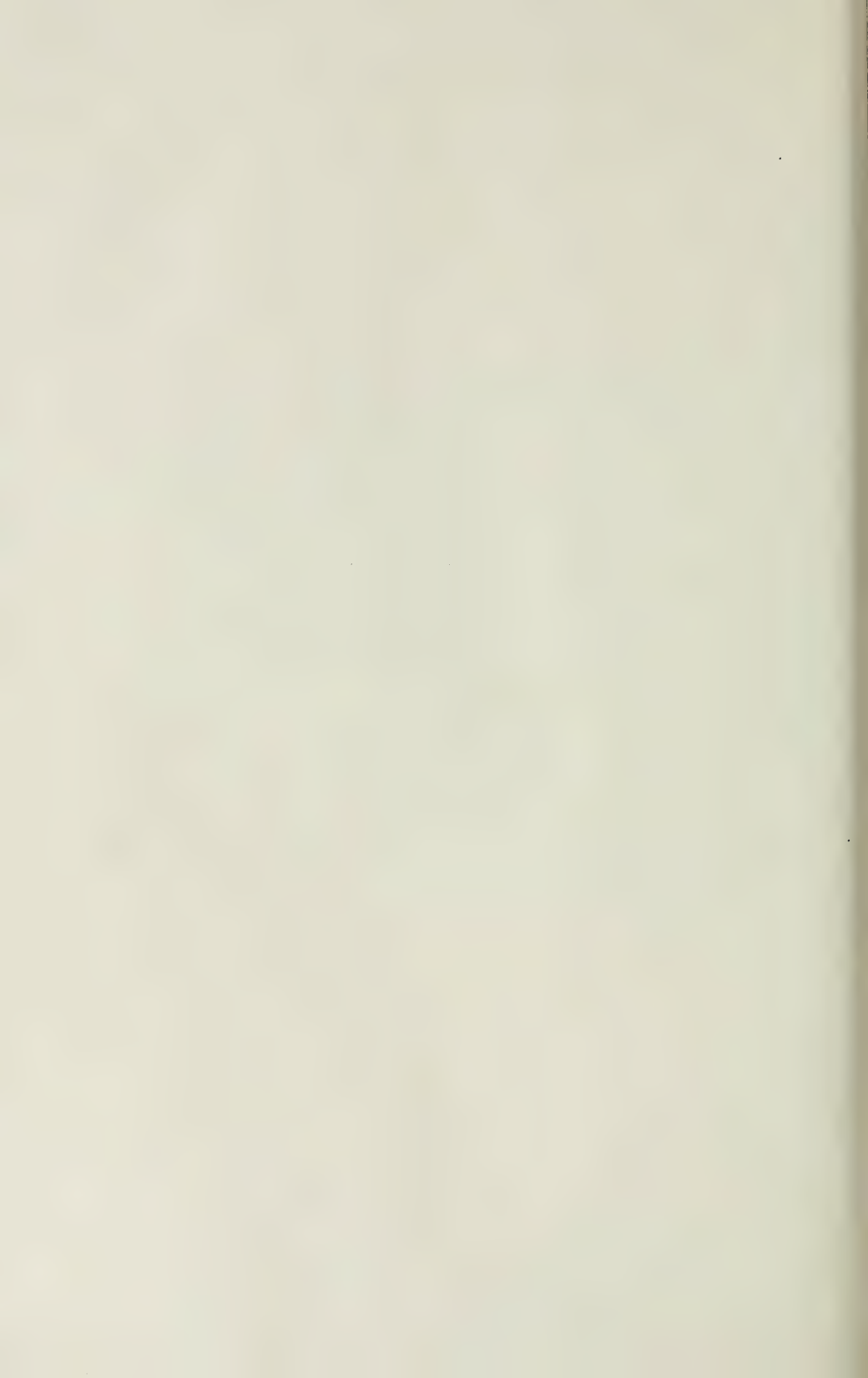
FIG. 3.



Line of suture of
patella periosteum
to femoral perios-
eum

Line of suture of
patella periosteum to
tibial periosteum

Periosteum of the patella stitched to that of the femur and tibia.



CASE IV.—Annie H., age sixteen years. Infantile paralysis. Loss of control of right knee.

Operation.—September 15, 1909. Result, patella slipped from its bed and became adherent to the femur. The second operation was on October 18, 1910, the patella being replaced horizontally. January 10, 1911, the ankylosis is firm, though short plaster still worn.

CASE V.—Sarah W., age seventeen years. Infantile paralysis. Loss of control of right knee.

Operation.—September 30, 1909; walked in plaster October 13, 1909. All support removed in six months. Result, firm bony ankylosis, patella put in the joint horizontally.

CASE VI.—Mary S., age thirteen years. Infantile paralysis. Loss of control of left knee.

Operation.—October 11, 1909; walked in plaster November 3, 1909. All support removed after five months. Result, complete bony ankylosis.

CASE VII.—Isaac S., age fifteen years. Infantile paralysis. Loss of control of left knee.

Operation.—November 1, 1909. All support removed in five months. Result, complete bony ankylosis.

CASE VIII.—Concetta S., age sixteen years. Infantile paralysis. Loss of control of knee.

Operation.—November 26, 1909; periosteum of the patella preserved and stitched, as shown in the illustrations. In four months all support was removed. Result, complete bony ankylosis.

CASE IX.—Emma T., age fourteen years. Infantile paralysis. Loss of control of right knee.

Operation.—July 12, 1910; operation, as in Case VIII. Walked in plaster September 27, 1910. In four months all support was removed. Result, complete bony ankylosis.

CASE X.—Rachael G., age twelve years. Infantile paralysis. Loss of control of right knee.

Operation.—July 22, 1910, as in Case VIII. Walked in plaster September 27, 1910. All support removed in four months. Result, complete bony ankylosis.

INTUSSUSCEPTION IN THE ADULT.*

TWO CASES, ONE DUE TO MULTIPLE ADENOMATA OF THE INTESTINE, THE OTHER
TO A SARCOMA OF THE CÆCUM: WITH A DISCUSSION OF
ADENOMATA OF THE INTESTINE.

BY STEPHEN H. WATTS, M.D.,

OF CHARLOTTESVILLE, VA.,

Professor of Surgery in the University of Virginia; Surgeon-in-Chief to the
University of Virginia Hospital.

INTUSSUSCEPTION is the most frequent variety of ileus, and, according to Leichtenstern, forms 30 per cent. of all cases of ileus. Although it is far more frequent in children, it is not altogether rare in adults.

As regards etiology, we must distinguish between the invaginations in small children and those in older children and adults. In the former the cause is usually to be sought in peculiarities of development and function of the intestine, which are generally not of a pathological nature, while in the adult, as a rule, we find some gross lesion of the intestine to be the underlying cause of the invagination. Of these lesions the most frequent and best known are tumors of the intestinal wall, and it is not often the malignant tumors that give rise to the intussusception though they may be at fault, but the benign tumors, cysts, adenoma, angioma, myoma, lipoma, and fibroma, especially when they are pedunculated. Among other causes of intussusception are ulcerations of the intestine, inverted appendices, and Meckel's diverticula.

In this connection it might be of interest to examine somewhat more closely into the etiology and mechanism of intussusception, as some further light has been shed upon the subject in recent years by the publications of Lorenz, and Delore and Leriche.

According to Nothnagel, invagination is due to an ab-

* Read before the Southern Surgical and Gynæcological Association, December 15, 1910.

normally active tetanic contraction of a circumscribed portion of the bowel, that part of the bowel below the constricted portion being drawn up over it, apparently by the action of the longitudinal muscle fibres, the intussusceptum growing at the expense of the ensheathing bowel. In order that an invagination may take place, it is necessary that one portion of the bowel involved in the intussusception possess at least a certain degree of mobility. This is always present in the small intestine, but in order for the large intestine to become invaginated, it is necessary for its embryological mobility to have persisted abnormally or for it to have acquired a loose mesocolon secondarily by traction.

Whereas various explanations, such as the disproportion in size of the ileum and colon, the fixed condition of the colon and the mobility of the ileum, a tenesmus-like spasm of the ileocæcal valve, etc., have been advanced to explain the great frequency of intussusceptions in the ileocæcal region, Lorenz, and Delore and Leriche believe that the abnormal mobility of the colon, mentioned above, is the chief cause of these invaginations. The fact that perhaps 68 per cent. of cases of intussusception occur in children under one year of age is easily explained by this congenital hypothesis. It is only in the latter part of intra-uterine life that the ileocæcal region (the usual site of intussusception) begins to be fixed. This fixation takes place slowly and at birth is not always completed; 48 per cent. of fetuses at term have a mobile cæcum and consequently in the first days of life the cæcum can be invaginated more or less extensively. Gradually, however, the fixation advances and in 85 per cent. of adults the first part of the large intestine is firmly fixed in the right iliac fossa, while in 15 per cent. it enjoys a certain degree of mobility, due either to a congenital abnormality or to a long mesocolon which has resulted from traction. When we remember that in some cases of invagination the ileocæcal valve may reach the rectum, we must realize the great mobility of the cæcum and colon in these cases.

While the various forms of intussusception—ileocæcal,

enteric, colic, ileocolic and iliaco-ileocolic—are generally described as occurring in the order named, Lorenz, and Delore and Leriche find that in many cases of so-called ileocæcal invagination the apex of the intussusceptum is formed, not by the ileocæcal valve but by the head of the cæcum and the appendix, and are really cases of cecocolic intussusception. Lorenz thinks the appendix plastered to the head of the cæcum may act as a tumor and be of some moment in the production of such intussusceptions.

There is also some discussion as to the manner in which pedunculated tumors give rise to invagination. Some say the invagination is produced by the mere weight and pull of the tumor on the intestinal wall as it is carried forward by peristalsis and the stream of fecal material; others believe that the presence of the tumor excites a violent peristalsis, which results in the formation of an invagination, and state that if the former view were true the tumor would always occupy the apex of the intussusceptum and this is not always the case.

It has been my fortune to meet with two cases of intussusception which were due to tumors in the intestine. These I will describe in some detail:

CASE I.—*Intussusception due to multiple polypoid adenomata of the intestinal tract.*

S. P., aged twenty-four years, Russian, was admitted to the Johns Hopkins Hospital, August 7, 1906, complaining of abdominal pain.

Family History.—Unimportant. No history of similar trouble in his family.

Personal History.—When five years of age he had prolapsus of the rectum. With each defecation the bowel would prolapse for an inch or two, but was usually easily reduced. Occasionally there would be some bleeding. This condition lasted for some years and disappeared spontaneously.

Present Illness.—For the last three years the patient has noticed occasional cramp-like pains in the abdomen, which usually lasted only a few minutes. These pains were diffuse, not well

localized, and did not incapacitate him for work. Occasionally he would vomit. Six months before admission the cramps became more frequent, sometimes lasted from one-half to one hour, and were usually located in the region of the umbilicus. The pains apparently bore no relation to taking food or to defecation. He vomited every few days, though his bowels remained regular. He stated that he was unable to work for three months, then worked for a while in a desultory way. Four days before admission, soon after luncheon, the patient had a normal movement of the bowel, followed in a few minutes by a dull nauseating pain in the region of the navel, and he vomited once, vomitus consisting of food he had eaten shortly before. Bowels moved twice the next day. Consistency of stools normal. No further vomiting, but a continuous dull pain in the region of the navel for two days before admission. Patient was unable to sleep on account of the pain and nausea. On further questioning, he stated that three years ago he had a similar attack with intense pain, diarrhœa, and bloody stools, which lasted a month.

Examination.—Patient was a pale, rather poorly nourished man. Pulse 96 to the minute, temperature 100, leucocytes 15,600. Examination of lungs, heart, and urine negative. The abdomen was somewhat distended, and numerous loops of intestine could be seen traversing the abdomen in a ladder pattern. Definite peristalsis noted at times. In the right side of the abdomen there was a large sausage-shaped mass which extended from the right iliac fossa to beneath the costal margin. This mass was fairly soft but varied in consistency. Rectal examination negative.

First operation, Aug. 7, 1906: Exploratory laparotomy; reduction of intussusception.

An incision was made over the right rectus muscle opposite the umbilicus. The peritoneal cavity was found to contain a small amount of free fluid. The lower portion of the small intestine was greatly distended, being 10–12 cm. in diameter, and the walls of the intestine were somewhat hypertrophied. The obstruction was found to be due to an intussusception, 25 cm. long, in the ileocæcal region, apparently of the iliaco-ileocolic variety. It was reduced by milking the colon and making slight traction on the ileum. There were few if any adhesions and no gangrene. Examination of the ileum after reduction showed the presence of two tumors 3 and 6 cm. in diameter, one 25 cm.

above the ileocaecal valve, the other and smaller 20 cm. higher up in the intestine. They seemed to be pedunculated, rather spherical in shape, smooth, and fairly soft. The larger tumor was apparently the cause of the intussusception, as traction upon it had caused an umbilication over its attachment, which was near the mesentery. The third tumor, which was about 6 cm. in diameter, was palpated in the sigmoid colon. It was deemed inadvisable to remove any of the growths on account of the distended condition of the bowel. It was thought that this could be done to better advantage at a subsequent operation. The wound was closed without drainage.

Second operation, Aug. 14, 1906: Laparotomy; reduction of intussusception; resection of 17 inches of ileum.

Patient's symptoms were entirely relieved by the first operation until August 12, when his abdominal pains returned and on August 14 his condition was about as when he was admitted. The wound was reopened and practically the same condition of affairs found as at the former operation. The intussusception was perhaps somewhat longer than before, and was reduced with more difficulty owing to œdema of the intestine. About 17 inches of ileum containing the two tumors (Fig. 1), was excised. The bowel was united by a lateral anastomosis, and the abdominal wound closed after placing an iodoform gauze drain down to the ends of the intestine, which were brought beneath the lower end of the incision.

Third operation, Oct. 8, 1906: Resection of colon and lateral anastomosis of the small intestine.

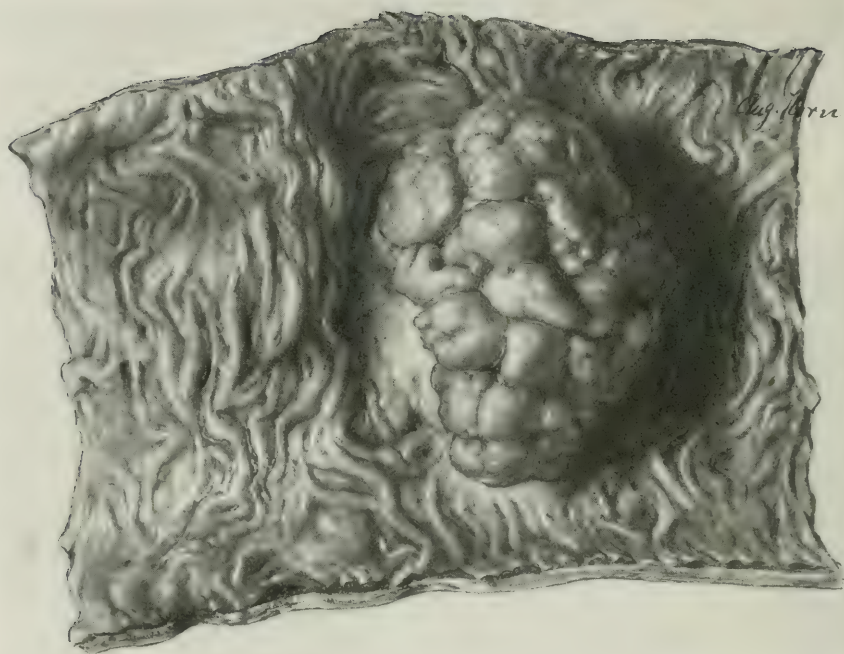
Since the last operation the patient had done well except that a small intestinal fistula, which resulted, continued to discharge. It was thought that this might have been kept open by the obstruction produced by the tumor in the sigmoid. An incision was made through the lower portion of the left rectus muscle, and about four inches of the sigmoid containing the tumor was excised (Fig. 2), and the bowel united by a lateral anastomosis. The intestinal tract was then thoroughly examined for further tumors; none were found in the large intestine, but numerous soft pedunculated tumors were found in the small intestine. One of these, several feet above the former iliac anastomosis, seemed to be producing a slight invagination, so a lateral anastomosis was done, shunting it out. The abdomen

FIG. 1.



Section of small intestine showing tumors.

FIG. 2.



Section of large intestine with adenoma.

was then closed, a small drain being placed down to the large intestine suture.

Fourth operation, Jan. 3, 1907: Excision of multiple adenomata of the small intestine; lateral anastomosis of the small intestine; closure of intestinal fistula.

Since the last operation the patient had done nicely, but the intestinal fistula still discharged somewhat. An incision was made through the upper portion of the left rectus muscle. The jejunum was first examined and found to contain numerous soft masses, evidently intra-intestinal growths. One of these was situated just below the junction of the duodenum and jejunum. The growths were removed through small incisions in the intestine opposite to the mesentery, their pedicles being clamped and ligated with catgut. In this manner four tumors 2 to 3 cm. in diameter were removed from the jejunum. The small intestine was then examined systematically from the jejunum downward, and five other growths found and removed as above. One of these was somewhat sessile, and after excising its base and closing the opening in the intestine, the intestinal lumen was found to be so much narrowed that it was necessary to do a lateral anastomosis around the stricture. The abdominal wound was then closed, and the persistent intestinal fistula from the second operation dissected out and sutured.

The patient recovered rapidly after the operation, and was discharged from the hospital on March 8, 1907. To sum up, the following operations were performed upon him: an operative reduction of intussusception, two intestinal resections with lateral anastomoses, two other anastomoses, and seven enterotomies.

He was seen about a year after his discharge from the hospital and was in good health.

Pathology.—The tumors removed vary from 1 cm. to 6 cm. in diameter. They are generally of a reddish color, though several are yellow or grayish, and most of them are pedunculated, while a few are more or less sessile. In some the surface is smooth, but most have an irregular, somewhat papillomatous appearance. This is particularly true of the large tumor, causing the original invagination, which has a cauliflower-like structure. They seem to have little if any tendency to invade the intestinal wall. Microscopically they present the typical picture of adenomata, namely a hyperplasia of the glands of Lieberkühn upon a stroma of connective tissue, the glands being very similar to those of the normal mucosa, but are larger and show a greater tendency

to branch. At the edges of the larger tumor (Fig. 1) the glands seem to invade the submucosa and thus suggest carcinoma, but the character of the cells does not point to malignancy and there is apparently no invasion of the lymphatics.

CASE II.—*Intussusception due to a sarcoma of the caput cæci.*

Mr. R. K., aged nineteen years, student, was admitted to the University of Virginia Hospital on May 25, 1910, complaining of pain in the right side of the abdomen and discharge of blood from the bowel.

Family History.—Unimportant. No history of tuberculosis or new growths.

Personal History.—He has had mumps, whooping-cough, chicken-pox, and recovered without sequellæ. No other diseases. Has had no symptoms pointing to disease of the heart, lungs, or kidneys. Until present illness digestion has been good. Bowels have been regular, and there has been no vomiting of blood, no bloody diarrhœa, no hemorrhoids.

Present Illness.—Patient was taken sick while in Baltimore about three or four weeks before admission to the University of Virginia Hospital. For about a week patient had had fleeting pains in the lower right abdomen. These became more severe, and at the end of a week he went to bed and took a dose of castor-oil. The next day his bowels moved and he passed a good deal of dark blood. The pain in the abdomen became more severe and general, though it was always worse on the right side, and he was taken to a hospital. He was not nauseated, did not vomit, and had no temperature. Blood appeared in each bowel movement, and the pain was always most marked just before the bowels moved. Appendicitis was suspected, but the bloody stools caused this diagnosis to be abandoned. The patient remained in the hospital and gradually became better. The pain disappeared, the hemorrhage from the bowel ceased in ten days, and the patient came to his home in Virginia after fifteen days. Four days after coming home he had another attack. This time the pain was more intense and more sudden in onset, and patient again passed blood by the bowel. On the day before admission, he was nauseated, vomited, and, the pain continuing, he was brought to the hospital.

Examination.—Patient was a well-nourished young man, but quite anæmic and looked rather sick. Pulse good volume, fair

tension, 84 to the minute, temperature 99.5, leucocytes 11,000. The abdomen was somewhat distended, but no loops of bowel could be seen and there was no visible peristalsis. The whole abdomen was rather tense, and no mass could be felt even on deep palpation. There was slight general abdominal tenderness and marked tenderness in the lower right abdomen. An enema was given and brought away considerable dark bloody material. No definite diagnosis was made.

Operation, May 25, 1910: Exploratory laparotomy; reduction of cæcocolic intussusception and excision of tumor of the caput cæci.

An incision was made through the right rectus muscle opposite to the umbilicus. The small intestine was not much distended, but the large intestine was considerably so. A soft mass the size of a goose egg was felt in the upper abdomen, and proved to be a large blood-clot in the transverse colon. It was milked down into the rectum and a considerable amount of blood expressed from the anus. In the region of the cæcum a doughy mass, 13 cm. in length by 7 or 8 cm. in width, was felt, and on examination proved to be an intussusception of the cæcum. It was purely a colonic intussusception, as the ileocæcal junction and appendix were in no wise involved. The intussusception was reduced by milking the colon, and after the reduction a small mass about 6 cm. in transverse diameter by 2 cm. in thickness was felt in the head of the cæcum. It was apparently an intestinal polyp, which occupied the apex of the intussusceptum and was doubtless the cause of the intussusception. The intestine was opened at this point and the polyp, which had a pedicle about 2-3 cm. in diameter, was excised with an elliptical portion of the wall of the gut. The opening in the intestine was closed with a continuous linen suture and then the abdominal wound was closed, a small drain being placed down to the intestinal suture. The patient made a good recovery and left the hospital June 18, 1910. He was seen four months later and appeared to be in excellent health.

Pathology.—The tumor, which measures about 6 cm. in transverse diameter by 2.5 cm. in height, is attached to the intestinal wall by a pedicle about 3 cm. in diameter. It is of a dark red color, has a ragged, somewhat villous looking surface, and is covered by rather adherent blood-clots. It seems to show little tendency to invade the intestinal wall.

Microscopic Examination.—Section of large intestine. A small bit of normal mucosa is seen at either end of the section. In the rest of the section the mucosa is replaced by a new growth, which invades the submucosa and extends a short distance into the muscularis. The serosa is normal. The new growth is made up of small round cells, with moderately darkly staining, somewhat vesicular nuclei, surrounded by a moderate amount of non-granular, lightly staining protoplasm. Very few mitotic figures are seen. There is everywhere a minimum of stroma and many small and large, new-formed blood-vessels, the tumor cells being in contact with the single layer of endothelium forming the blood-vessel wall.

Diagnosis.—Small round-cell sarcoma, arising in the submucosa.

Inasmuch as adenomata are the most frequent tumors giving rise to intussusception, and since one of my cases was due to such tumors, it behooves us to study them more carefully. In the following remarks upon adenomata of the intestine the very excellent article of Smoler has been consulted freely.

Adenomata of the intestine are usually found by pathologists in persons who have died from other causes and in whom the tumors have produced no symptoms. They appear in all parts of the intestine, though their favorite seat is the large intestine and especially the rectum. Smoler, who collected all of the cases in the literature, found numerous cases where they occurred in the large intestine and rectum, but only nine cases where they were located in the small intestine. Children from four to seven years of age seem to be chiefly affected.

Adenomata vary greatly in number, size, shape, and color. They may occur singly or, on the other hand, may be found throughout the intestinal tract, and number thousands. As a rule they range in size from that of a pea to that of a walnut, though they may be as large as an orange. They are sometimes sessile, but are usually pedunculated, are usually red and soft, sometimes firmer, have generally a smooth surface, but not infrequently are uneven or cauliflower-like.

They take their origin in the glands of Lieberkühn and in the duodenum from Brunner's glands, and their structure

resembles that of the normal mucosa, but the glands are longer and show a greater tendency to branch. It is sometimes hard to distinguish between benign adenomata and those becoming malignant, and it is impossible to rule out malignancy without a careful examination of all the specimens, especially their edges where they join the normal mucosa. Some say an adenoma is malignant when it extends through the submucosa, others when it extends through the muscularis mucosæ, and still others base their diagnosis on the character of the individual cells. In adenomata the protoplasm is clear, there is much mucus, and the nuclei are small and dark, whereas in cancer the protoplasm is finely granular, the mucus is less in amount, and the nuclei are large, contain much chromatin, and show active mitosis.

Clinical Symptoms of Adenomata.—These are in general somewhat varied, and depend chiefly on the size and location of the tumor. A small tumor in the rectum may cause more symptoms than a larger tumor in the small intestine, owing to the firmer nature of the large intestine content, and will therefore probably more frequently give rise to hemorrhage; moreover, blood from the small intestine may be so changed as not to be recognized in the fæces, though the anæmia of the patient may point to bleeding.

Subjective disturbances only appear when the bowel is more or less obstructed. In certain cases the cramps may be due to increased peristalsis or to a small intussusception which becomes reduced spontaneously, but when they are violent and continual, invagination, which is one of the most serious complications, has probably taken place. Many cases of invagination due to adenomata are chronic, and paroxysms of abdominal pain, occurring at intervals, which intervals tend to become shorter, point to invagination rather than to other forms of chronic obstruction. The presence of mucus and blood in the stools of an adult, with interval cramps and movable abdominal tumor, will often indicate an intussusception due to a benign tumor, and of these the adenomata, though rare, are the most frequent.

The nearer the polyps are to the lower end of the bowel,

the greater are the symptoms of irritation. In most cases with polyposis of the large intestine, there is a profuse diarrhœa, which may appear daily without pain or cramps. The chronicity of the illness even in these cases (stretching over several years) without great debility in the patient is striking. The diagnosis in cases of polyps of the rectum may be facilitated by the tenesmus and sometimes by prolapsus of the rectum or even of the tumor.

Etiology.—The etiology of intestinal adenomata has remained obscure in spite of a great deal of work in this direction. Inasmuch as we find a hyperplastic condition of the intestinal mucosa accompanying certain ulcers and inflammations of the intestinal tract (apparently a reparative process), some investigators have considered adenomata to be the result of such chronic inflammatory conditions. Thus some have dysentery to answer for the formation of adenomata, especially since certain forms of polyps have been known to appear after dysentery.

Nothnagel calls attention to the fact that they occur very frequently in children, and König thinks they arise from a congenital anlage. Smoler advances the theory that the presence of a congenital anlage plus a pathological hyperæmia, due to inflammation, might account for the formation of adenomata. However, the real etiology of adenomata will probably not be forthcoming until we have a better knowledge of the origin of tumors in general.

Prognosis.—The prognosis of intestinal adenoma varies so with the nature of each case that it seems impossible to make any general statement in regard to it. The prognosis will be doubtful or unfavorable when the distribution of the tumors is so extensive that radical operation is out of the question, while single polyps in different parts of the intestine are of better prognostic import. The prognosis, therefore, depends entirely upon the possibility of a radical operative therapy: it is good when the focus of disease can be removed, bad in inoperable cases. The chief complications of adenomata are hemorrhage, invagination, and carcinomatous degeneration. The few cases reported seem to indicate

that the last is a rare complication and occurs perhaps more frequently in the sessile than in the pedunculated tumors.

Treatment.—Regarding the operation for polyps of the large and small intestine, there is not much to say. For single tumors, enterotomy and excision of the growth, after ligation of its pedicle, is recommended. For more extensive involvement, resection of the intestine may be advisable. For invagination, suitable surgery is demanded.

In the very extensive cases of polyposis of the large intestine and rectum the simple removal of the tumors from the rectum is of little value and can hardly be called a palliative operation, as the symptoms usually return so quickly. Extensive resections, with the production of a new anus, may be necessary, or it may be advisable to shunt out portions of the gut by lateral anastomosis or artificial anus. The use of local astringents and applications may be of service in inoperable cases.

REFERENCES.

- Baltzer: Ueber primäre Dünndarmsarkome., Arch. f. Chir., Bd. 44, 1892, S. 717.
 Bidwell: Intussusception Caused by Inverted Meckel's Diverticulum, Lancet, 1907, ii, 682.
 Coffey: Intestinal Intussusception, ANNALS OF SURGERY, vol. xlv, 1907, p. 42.
 Delore and Leriche: De l'invagination intestinale, Revue de chirurgie, Tome 38, 1908, p. 39.
 Hauser: Ueber polyposis intestinalis Adenomatosa, Deutsches Archiv. f. klin. Med., Bd. 55, S. 1895.
 Hiller: Ueber Lipome des Magendarmkanals, Beiträge zur klin. Chir., Bd. 24, 1899, S. 509.
 Kothe, R.: Dünndarminvagination durch Einstülpung eines Meckelschen Divertikels, Deutsche Zeitschr. f. Chir., Bd. 95, 1908, S. 286.
 Lorenz, H.: Ein Beitrag zur Lehre von der Invagination, Deutsche Zeitschr. f. Chir., Bd. 77, 1905, S. 7.
 Magnoux: De l'invagination intestinale par tumeur et en particulier par les myomes de l'intestin, Lyon, 1899.
 Riedel, I.: Ein Beitrag zur Darminvagination, Deutsche med. Wochenschr., Bd. 35, 1905, S. 1655.
 Siegel: Ueber das primäre Sarkom des Dünndarms., Berliner klin. Wochenschr., 1899, S. 767.
 Smoler: Ueber Adenome des Dünn und Dickdarms., Beiträge zur klin. Chir., Bd. 36, 1902, 139.
 Sprengel: Eine angeborene Cyste der Darmwand als Ursache der Invagination, Arch. f. klin. Chir., Bd. 61, 1900, S. 1032.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, December 14, 1910.

The President, DR. ELLSWORTH ELIOT, JR., in the Chair.

PERFORATED GASTRIC ULCER; PNEUMOCOCCUS SUBPHRENIC ABSCESS.

DR. WALTON MARTIN presented a woman, 38 years old, who was admitted to the Roosevelt Hospital on December 25, 1908. Her chief complaint was an agonizing pain in the upper abdomen. Just as she seated herself at her Christmas dinner she had felt a sudden stabbing pain in the epigastrium. This continued, and began to radiate to the left shoulder-blade and shoulder. In the course of an hour the abdominal pain became general, and of a "hot, acid" character. An ambulance had been called, and she was taken to the hospital.

The patient stated that for four months previous to this attack she had had marked soreness in the upper abdomen which radiated to the left side of the back. The pain had come on usually about half an hour after eating and persisted several hours. Her appetite had been good, but she had starved herself on account of the pain, and had lost much weight as a result. The pain had not seemed to be influenced much by the character of the food. There was no history of vomiting. For the past five weeks the stools had been very black. About ten months previous to her admission she had been operated on at the Gouverneur Hospital, a nephropexy and appendectomy having been performed. For sixteen years she had had indigestion; otherwise her past history was negative.

The physical examination on admission to the hospital had shown a rigid abdomen, very tender in the epigastrium, with tympany on percussion over the liver area. The pulse was 92; respirations, 40; temperature, 100.4°. A blood examination showed 18,200 leucocytes.

At 3 A.M. on December 26, about eight hours after the onset of the pain, the abdomen was opened in the median line under ether anæsthesia. There were gas and gastric contents in the peritoneal cavity, and an indurated ulcer, with a round, punched-out perforation situated near the lesser curvature at the cardiac end of the stomach. The perforation was closed with Halsted sutures of linen, the abdomen was irrigated with normal salt solution until cleansed of gastric contents, and the abdomen closed without drainage. The patient's condition on the following day was satisfactory. On the eighth day the stitches were removed, the median laparotomy wound having healed by primary union.

On the thirteenth day there was a slight rise in temperature. This persisted with an irregular rise and fall. On the twenty-second day it was 102° in the afternoon, but the patient felt well and was gaining weight. On the thirty-ninth day there was still the irregular temperature; the leucocyte count showed 16,700 white cells, the patient had gained seven pounds in weight, and the abdomen was soft and not tender. On the fiftieth day there was dulness over the lower portion of the right chest with pain on breathing, and through a needle introduced in the midaxillary line between the ninth and tenth ribs about 10 c.c. of greenish yellow, foul-smelling pus was withdrawn. The next day, under ether anæsthesia, the ninth rib was resected, the diaphragm incised, and several ounces of pus evacuated from a subphrenic abscess. From that time on the patient made an uninterrupted convalescence, leaving the hospital on the 21st of February, 1909. She had continued in good health, and had gained 28 pounds.

Cultures taken from the pus from the subphrenic abscess showed a pure culture of pneumococci. It was interesting to note that in the monograph by A. Weichselbaum on the *Diplococcus pneumoniae* in Kolle and Wasserman's "Handbuch der pathogenen Mikro-organismen," he calls attention to the fact that in the cases of pneumococcus peritonitis observed by him, as well as in the case reported by Bantis, there was a chronic gastric ulcer or a carcinomatous ulcer of the stomach, and he suggested that the pneumococcus had gained entrance to the peritoneum through the lesion in the stomach.

DR. CHARLES H. PECK said he had recently had a case of

subphrenic abscess in which the pus showed a pure culture of pneumococcus. This organism was also found in the blood, and the patient subsequently developed a right empyema, also of pneumococcic origin. Following this there was a patchy pneumonia, first on one side and then on the other, which proved fatal. This patient gave a distinct history of gall-stones, but the primary lesion, so far as could be made out, was the subphrenic abscess.

PARTIAL THYROIDECTOMY FOR EXOPHTHALMIC GOITRE.

DR. MARTIN presented a negro woman, 23 years old, who was admitted to St. Luke's Hospital on March 21, 1910. Her weight on admission was 129 pounds, and she stated that she had lost about 50 pounds. There was marked exophthalmus, and the pulse ranged between 100 and 120. There was a fine tremor of the hand. In the neck was a moderately large, soft goitre. The patient suffered from attacks of cardiac palpitation, with flushing sensations. She said she felt miserable and nervous, and for a month past had been unable to work.

On March 26 the right half of the thyroid was removed under ether anæsthesia. The portion removed was about the size of an apple, soft, solid, vascular, and dark in color. Microscopic examinations showed some colloid areas, and in many places epithelial papillæ had grown out into the lumen of the follicles. The cells were more abundant than in ordinary goitre.

Immediately after the operation the patient's temperature was 104°, pulse 140. On the following day the afternoon temperature was 106°, pulse 160. On the third day the temperature had fallen to 103°, but the pulse was even more rapid, varying between 160 and 180. From that time on she began to improve, and left the hospital April 7, 1910. Since then she had gained 42 pounds in weight. Her present weight was about 170 pounds, and she was again able to earn her living by doing general housework. The exophthalmus was a little less pronounced; the pulse was about 100. The tremor of the hands had disappeared, but she still had occasional attacks of palpitation. The remaining portion of the thyroid had increased a little.

The improvement in the patient's nutrition, as shown by the gain in weight as the result of the partial thyroidectomy, was the striking feature of the case.

NEPHROTOMY FOR SUPPURATIVE NEPHRITIS
FOLLOWING LUMBAR URETEROSTOMY.

DR. MARTIN presented a negro woman, 44 years old, whom he had previously shown in October, 1909. He had operated on her at St. Luke's Hospital on Sept. 3, 1909, about one year and four months ago, removing the carcinomatous bladder and uterus, and implanting the ureters into the loins. In the discussion of the case at that time, the late Dr. Samuel Alexander brought up the point of the relative advantages and disadvantages of ureteral loin implantation and double nephrotomy, as advocated by Watson in a paper published in the *ANNALS OF SURGERY*, in 1905.

The patient was again brought before the Society to illustrate some of the points under discussion at that time. It was pointed out at the time she was shown that the drainage from the left ureter had been unsatisfactory at times, and that there was a tendency for the epithelium to close the ureteral orifice. On the right side there was no such tendency, the mucosa of the ureter having firmly established itself up to the level of the skin.

This tendency of the left ureter to close, with a resulting damming back of the urine, had continued, and from time to time last winter it was necessary to dilate the orifice of the ureter. On April 26, 1910, the flow of urine from the left ureter ceased, and the patient had a chill and vomited. Her temperature rose to above 104° and her pulse to 128. There was pain and tenderness over the left kidney. The passage of a small catheter into the orifice of the ureter withdrew but a few drops of pus. It was evident that there was a suppurative inflammation of the left kidney. The patient was accordingly again admitted to the hospital, and on April 29, 1910, a nephrotomy was performed and a tube introduced into the pelvis of the kidney. Several ounces of pus were evacuated. The patient made an uneventful recovery, and left the hospital May 14. Since then she had worn a small tube in the nephrotomy opening; this she removed daily, cleansed, and reinserted. Messrs. Stohlmann and Pfarre, the instrument makers, had fitted for her an ingenious apparatus which had greatly added to her comfort: on one side a cup with an inflated rubber

cushion was held in place by a spring band passing around the body like a truss spring, and on the other side a catheter passed through a hard rubber disk, and was held in place by the same spring. Both cup and catheter connected with a bladder which hung from her thigh.

The patient had continued in good health and had shown no evidences of a recurrence of the carcinoma. She had gained in weight and was able to do her housework. The patient had found the side on which the nephrotomy had been performed easier to care for than the side on which the ureter was implanted, the adjustment of the cup to collect the urine being difficult, and leakage occurring readily.

Dr. Martin said the case illustrated that a kidney draining freely, either through the ureter or directly from the pelvis through the kidney substance, was well tolerated by the patient, and he believed there was less danger from obstruction of the drainage following a nephrotomy than from the ureterostomy, but he thought that he should again be inclined, after a complete cystectomy, to do a loin transplantation of the ureters at the time of the cystectomy, as the shock and bleeding were less than in a nephrotomy, and later, if there was trouble with the drainage, as in this case, it would always be possible to perform a nephrotomy.

Dr. CHARLES L. GIBSON said that, aside from the excellent kidney drainage and the ingenious apparatus by which the patient enjoyed comparative comfort after complete cystectomy, the case shown by Dr. Martin was a remarkable example of what could be accomplished in these advanced cases of carcinoma of the uterus involving the bladder. The operation was done in September, 1909, and the patient was apparently enjoying excellent health. The case should prove an incentive to others to do as radical an operation as possible in the face of these apparently hopeless conditions.

LIVER ABSCESS IN A CHILD.

Dr. FRANK S. MATHEWS presented a boy, ten years old, who was admitted to St. Mary's Hospital for Children on July 26, 1910. He had been sick for ten days, with fever, vomiting, and pain in the right side. On admission his temperature was 105.8°; there was muscular twitching, and pain

and rigidity in the right loin and hypochondrium. The liver border was abnormally low, and the right kidney easily palpable.

Dr. Mathews said that, although abscess of the liver was not especially uncommon in the children of the tropics, it was exceedingly uncommon in New York, and in the case presented it was considered, in the absence of any knowledge of a portal infection, that it was more likely one of renal than liver infection. Consequently, an incision was made in the loin, into which the kidney seemed to prolapse; however, it was seen that the kidney was normal, and was simply pressed downward by a mass above and in front.

Through a right rectus incision the free edge of the liver was exposed, and, passing the hand underneath, a mass of adhesions was encountered. Upon separating these, a soft spot was felt on the under surface of the liver posteriorly, and with the finger, an abscess, about the size of a lemon and containing creamy, odorless pus, was evacuated. This contained the *Staphylococcus aureus*. The abscess was drained through both incisions.

Five days later the boy was again operated upon for acute intestinal obstruction. Through a McBurney incision a collapsed coil of gut was found and traced up to the rectus incision, where it was adherent and angulated. Recovery followed, but the boy ran an irregular temperature for two months. His convalescence was interrupted by abscesses of low virulence containing the *Staphylococcus aureus*. These abscesses developed about two weeks after the liver operation; they were numerous and deep-seated in the cellular tissues, and one abscess formed in the inner tuberosity of the left tibia and another in the inner malleolus of the same bone. These later formed sequestra which had been removed by operation. The shaft and medulla of the bone remained normal. The lower epiphysis of the right humerus became the focus for further trouble: there had been a thickening of the bone at that point, and the joint had been repeatedly aspirated of synovial fluid, but no pus had formed. The patient's general health was now good, and he seemed on the road to recovery.

Dr. Mathews said he had no suggestion to offer as to the portal of infection in this case, other than that it did not come from the appendix. At the time of the operation for intestinal

obstruction the appendix was inspected and found normal, and, furthermore, the pus from the liver abscess lacked the odor of most appendical abscesses. The case had been treated only by surgical drainage of the abscesses. Vaccines had not been employed, as the speaker thought it useless to give a few millions of dead cocci to a patient whose blood and tissues were filled with billions of live ones.

DR. L. W. HOTCHKISS said he had seen two cases of liver abscess in children, aged nine and twelve years, respectively. Both cases ended in recovery.

DR. A. V. MOSCHCOWITZ said that liver abscess was of common occurrence in Mt. Sinai Hospital. About five years ago the speaker said he tabulated over 100 such cases, and of that number there was only one case in a child. In that case, which was under the care of Dr. Arpad G. Gerster, the liver abscess was traced to a trauma. There was a distinct history of antecedent trauma, with probably hemorrhage and secondary infection.

DR. MATHEWS said there was no history of trauma in his case.

DR. MOSCHCOWITZ suggested that the liver abscess in this case was possibly hæmatogenous and an expression of a general infection from which the child was suffering. Perhaps the multiple abscesses which developed subsequently were due to metastases from the liver abscess, or perhaps they were all expressions of a general infection.

DR. MATHEWS said that all of the abscesses made their appearance within ten days after the original operation. Whether the source of the original abscess was through a blood infection or whether the subsequent abscesses resulted from the liver abscess he was unable to say.

DOUBLE ACUTE NON-TUBERCULOUS COXITIS.

DR. MATHEWS presented a girl, five years old, who was admitted to St. Mary's Hospital for Children on May 31, 1910. She had been well until two weeks before, and was sent to the hospital as a case of tuberculous coxitis. On admission, she was acutely ill, with a temperature of 104° and the physical signs of bronchitis. The movements of the right hip were painful: the hip was held in a flexed position in outward rota-

tion; however, there were no spasm, no night cries, and scarcely any limitation of movement. Under ether, nothing definite could be made out.

Three weeks later the left hip became similarly affected. The leucocytosis was high (thirty to forty thousand) for several weeks, with a differential count of about 85 per cent. of polymorphonuclears. Repeated Von Pirquet tests were negative for tuberculosis. Smears from the vagina were repeatedly negative for gonococcus.

Both thighs were maintained in an extension apparatus for three months. Removal of the weights from either leg would be followed within two days by a considerable rise in temperature. After five months she was allowed out of bed, and she has been walking with some difficulty since.

This child, apparently, Dr. Mathews said, had an acute, non-tuberculous, non-gonorrhœal coxitis affecting both hips. The absence of flexion and spasm pointed to its primary synovial rather than bony origin. X-ray pictures at first showed normal bones; later, the acetabulum became excavated and deepened, and the femoral heads had been largely absorbed. New bone was now being formed around the joint. In spite of the deformity, the child was able to walk, and there was only moderate limitation of motion in flexion and rotation.

DR. ROYAL WHITMAN, discussing Dr. Mathews's case, said he was inclined to believe that the condition in the hip-joints was primary, as the temperature chart showed how perfectly the symptoms were under control when the joints were at rest. There was evidently a destructive process involving both joints, and he suggested that it might be well to place the limbs in abduction and relieve the pressure on the upper borders of acetabuli.

DR. MATHEWS asked Dr. Whitman if he saw any infections of this sort that were not tuberculous and which did not end in suppuration.

DR. WHITMAN replied that he had seen many cases of this type involving one joint, and that they were often mistaken for tuberculous disease. On this account he did not make a diagnosis of hip disease until the child had been under observation for a time, so that infections other than tuberculous might be eliminated.

BRAIN INJURY BY CONTRECOUP.

DR. MATHEWS presented a boy, eleven years old, who had always been well except for an injury four years ago. At that time a small piece of bone was said to have been removed over the left frontal eminence. The scar of that operation was apparent, and there was no doubt that there was a fracture of the left frontal bone.

Five days prior to his admission to St. Mary's Hospital for Children, four months ago, he fell into an areaway, a distance of three feet, striking the right zygoma on the tip of a sewing machine oil can. He was found unconscious a few minutes later by a physician, who sent him to a hospital. From then until his admission to St. Mary's he was said to have been in partial coma, with loss of sphincteric control.

Examination showed an old scar over the left frontal bone, and a small punctured wound over the right zygoma. There were no evidences of a fracture of the base or vault; no swelling nor ecchymoses. There was partial paralysis of the right side of the face, and complete paralysis of the right arm and leg. The tongue was deviated to the right. There was complete aphasia, the mouth was foul, and swallowing was difficult. The patient was excessively irritable, not unconscious, and followed movements with his eyes. His pulse for several days ranged between 50 and 60.

With all the symptoms pointing to a lesion of the left motor area, the question of operation arose, but action was postponed from day to day because of slight improvement, and although the slow pulse suggested compression, the blood-pressure was never recorded in excess of 110 mm.

When the boy left the hospital at the end of three weeks he was able to walk with difficulty; he understood perfectly, and could speak a few words. At present there was still slight facial palsy and some difference in the grasp of the two hands. The tongue protruded straight. For a time he was very emotional, but he was improving in that respect.

In this case, Dr. Mathews said, the trauma was upon the right zygoma, but there was no evidence of recent fracture. With the signs pointing to laceration or pressure on the left motor area, one was forced to think of adhesions about the site

of the injury of four years ago as concerned with his present symptoms. There had been no symptoms referable to his old injury in the intervening four years.

CONTROL OF HEMORRHAGE AFTER SUPRAPUBIC PROSTATECTOMY.

DR. F. KAMMERER presented a man, 72 years old, upon whom he had recently operated for prostatic hypertrophy. The case was shown to illustrate a point in the technic of the suprapubic operation. The speaker said he had been more favorably impressed with the latter operation during the past four years, and had practised it almost exclusively in preference to the perineal method, of which he had formerly been an adherent. The mortality had been and was still, perhaps, higher in the suprapubic cases, and this was, he thought, due in a great measure to the increased hemorrhage—not so much during as immediately after the operation. It was not an infrequent occurrence, after the enucleation of a large prostatic tumor from above, to have practically no hemorrhage at all from the wound surfaces of the bed of the prostate during operation, but it had happened to him in quite a number of cases, within the first hours following operation, to find that very alarming parenchymatous hemorrhage was going on after the patients had been returned to bed and placed in the horizontal position. In a number of cases he had been compelled to reopen the suprapubic wound, to pack the wound cavity of the prostate, and to exert digital pressure on the packing until the bleeding ceased. This had occurred in the patient he showed, who was operated on for an unusually large hypertrophy.

After repacking the bed of the prostate, very slight pressure of one finger would generally suffice to stop the oozing from the wound surfaces, and it had occurred to the speaker that this finger-pressure might be replaced by suture of part of the opening made during the enucleation of the prostate. To pack the cavity of the prostate with gauze, allowing the end of the tampon to protrude from the bladder above the symphysis, without any additional safeguard for retaining the tampon in position, was of little use. As soon as the tampon became soaked with blood and urine it would in part loosen up and fall into the bladder, and would not press against the wound surfaces, and

this would occur in a short time after the patient was returned to bed. In order to obviate this, the speaker had closed the irregular opening into the prostatic cavity in a transverse direction with three or four sutures of strong, plain catgut (non-chromicized), passing through the entire thickness of the bladder wall and the capsule of the enucleated prostate. The upper end of the opening was not sutured. Through this opening the tampon passed into the bladder and further through the suprapubic opening into the gauze dressing. The sutures were at first placed without tying them; the tampon was then introduced, and was of such size that when the sutures were tied, a certain amount of compression of the tampon would take place. A Freyer tube was put into the bladder above the projecting end of the tampon, and the wound was closed. The tube and the tampon were removed on the third day. There was no difficulty in withdrawing the tampon, as the catgut sutures in contact with the urine in the bladder evidently opened up in a day or two, thus practically re-establishing conditions that existed at the close of the enucleation of the prostate after the danger of post-operative hemorrhage had passed.

The speaker said he had employed this method in four cases of suprapubic prostatectomy with apparent success.

In reply to a question, Dr. Kammerer said he had thus far experienced no difficulty in introducing the sutures through the bladder wall and the capsule of the prostate. His incision into the bladder was about an inch or an inch and a half long but, of course, this incision could be stretched to almost any size necessary for removal of a large prostate. He had not resorted to the perineal operation as frequently lately, he said, because he had found that, technically, the suprapubic was simpler and possessed some advantages over the perineal method. When he did do the perineal operation, he always exposed the parts thoroughly by a curved incision in the perineum. He had never observed injury to the rectum or incontinence of urine, but had seen very troublesome perineal fistulæ after this method. One great advantage of the suprapubic method was the possibility of thorough inspection of the bladder without cystoscopy.

DR. JOHN F. ERDMANN asked Dr. Kammerer whether in his experience the increased mortality of the suprapubic operation

was due to hemorrhage. In the majority of cases, he thought, death was the result of renal insufficiency or to embolic conditions. Personally, he could recall no case where death was due to hemorrhage.

DR. KAMMERER said he did not mean to leave the impression that these patients died from hemorrhage, but he did think that a severe hemorrhage after a suprapubic operation would be an additional unfavorable factor, especially when conditions cited by Dr. Erdmann existed. In reply to a question as to whether he did the operation in two stages, Dr. Kammerer said he preferred to do it in one stage, unless there were evidences of severe infection.

DR. CHARLES L. GIBSON thought the suggestion of Dr. Kammerer very valuable in trying to improve the technic of the suprapubic operation. It was certainly open to improvement.

In doing the perineal operation, he emphasized the importance of greater respect for the musculature of the parts, and since he had adopted the intra-urethral incision, his results had been much better than formerly.

AVULSION OF THE TUBERCLE OF THE TIBIA.

DR. CHARLES L. GIBSON presented a man, 40 years old, who fell and bruised his right knee. There was slight pain, and an examination showed that an avulsion of the tubercle of the tibia had taken place. The bone was exposed, the fragment restored to its proper position, and an ordinary steel nail driven in to keep it in place. The patient remained in the hospital for twenty days, during which period the leg was immobilized. He made a good recovery, with perfect extension. In reply to a question, Dr. Gibson said the operation was extracapsular, the joint not being opened. The nail still remained *in situ*.

DR. JOHN F. ERDMANN said that about two and a half months ago he was called to Staten Island to see a young man who, while attempting to strike a ball at tennis, slipped and tore off the tubercle of the tibia and about two-thirds of the internal tuberosity of the tibia. The bone was exposed and the fragment sutured into place with kangaroo tendon. He recalled one other case in an adult which was treated by pressure entirely, no open operation being done.

DR. BENJAMIN T. TILTON said he had seen two cases of

avulsion of the tubercle of the tibia, one in a man, who four years previously had fractured the patella on the corresponding side, the fracture being sutured with wire. Two years later he fractured his opposite patella, which was sutured with chromic catgut. Subsequently he met with the same sort of an injury, producing this time an avulsion of the tubercle of the tibia; the fragment was sutured, with a very good result.

The second case was one where the tubercle was torn off and the fractured surface turned directly forwards, so that an open operation was absolutely indicated. The bone was exposed, the fragment turned back into its proper position, and sutured into place with chromic gut.

ACUTE HEMORRHAGIC PANCREATITIS.

DR. BENJAMIN T. TILTON showed this case. The patient was a Swedish woman, 29 years old, married, and the mother of one child. She was a moderate beer drinker, and denied venereal infection. Her general health had been good, excepting that she had had some "stomach trouble" for the past nine months. This had shown itself in the form of occasional attacks of vomiting after meals. The vomitus contained undigested food, mucus, and occasional blood. The last attack of vomiting occurred about two months ago, and the vomited material contained blood.

Thirty-six hours before Dr. Tilton saw the patient, in October, 1910, she experienced without warning a sudden, excruciating pain in the epigastrium. The pain was persistent, and finally extended over the entire abdomen and radiated to the chest behind the sternum. It was also felt intensely in the back. The pain was followed by vomiting and prostration, and the bowels were constipated. Her physician was compelled to give her several injections of morphine for the pain during the next twenty-four hours.

On admission to the hospital, the patient was in severe shock. The pulse was 150 and very weak, and the skin was cold and cyanosed. The rectal temperature was 103.4° and the respirations 50. The abdomen was markedly distended, tympanitic, rigid, and tender. The distention was most noticeable in the epigastrium. The abdominal symptoms were those of a general peritonitis. The blood count showed 14,000 leucocytes, with 87 per cent. of polynuclears.

Owing to the history of previous gastric disturbances, the sudden onset of the epigastric pain, and the intensity of the peritoneal symptoms, the diagnosis was made of perforated gastric ulcer and general peritonitis, although acute hemorrhagic pancreatitis was considered as a secondary possibility. On account of the extreme degree of collapse, a very unfavorable prognosis was given, but operation was advised and readily accepted.

Thirty-six hours after the onset of the symptoms, the abdomen was opened in the median line above the umbilicus, and a large amount of blood-stained fluid was encountered. This was present in greatest amount beneath the liver and in the lesser peritoneal sac. The intestines were markedly distended. Numerous areas of fat necrosis were found in the omental fat and on the peritoneal surface of the duodenum. The stomach was somewhat distended but otherwise normal. On exposing the pancreas, after raising the transverse colon, the former was found markedly swollen and abnormally soft. It was punctured with a pair of blunt scissors, and into the opening thus made a cigarette drain was introduced, and after washing out the bloody exudate, the abdomen was closed. The gall-bladder was somewhat distended, but no stones were felt within it or in the ducts.

The patient's condition was most critical after the operation, but she responded to free stimulation and the Murphy rectal irrigation, and subsequently made an uninterrupted recovery. Her temperature reached normal on the third day, and she has since been perfectly well.

The striking features of the case, Dr. Tilton said, apart from the unexpected outcome, were the sudden stormy onset, the persistence of very intense pain, and the close resemblance of the later symptoms to general peritonitis. Immense relief followed the simple removal of the peritoneal exudate, which gave rise to great tension. Drainage of the pancreas was apparently not a factor in the recovery, as the dressings were scarcely soiled, and the opening closed as soon as the drainage was removed.

DR. CHARLES H. PECK referred to a case of acute pancreatitis recently under his care, in which the symptoms were those of a rather obscure abdominal condition. Upon opening

the abdomen he found a cholecystitis, with marked pancreatic involvement. The gall-bladder was drained, but the pancreas was left undisturbed. As the patient continued to have some temperature, drainage was continued rather longer than was usual in cholecystostomy. After about a fortnight, a large, dense swelling was made out in the upper abdomen, and a second operation revealed a pancreatic cyst containing about 1500 c.c. of a clear, watery fluid. This had evidently developed in the interim between the two operations. Upon examination, this fluid was found to contain large quantities of proteolytic ferment. This was the first time, Dr. Peck said, that he had seen a pancreatic cyst develop under his eye. The amount of pancreatic tissue destroyed in this case must have been very considerable, judging from what could be seen and what came away with the drainage. Still, the patient seemed to have sufficient pancreatic tissue left to sustain life. The urine was found to contain sugar.

DR. HOTCHKISS said he had under his care at present a case similar to the one presented by Dr. Tilton. In his case, the patient gave a history of an acute seizure, with symptoms dating back about four days, and which was diagnosed as a small perforation of the stomach or duodenum. The patient, an alcoholic, apparently in good health, had gone to bed after eating a very heavy meal. He woke up during the night with severe epigastric pain, got up, took some whiskey, and vomited, and was brought to the hospital on the following day. Three days later he developed a swelling in the epigastrium, and was transferred to the surgical ward. Upon incision through the upper right rectus, the entire gastrohepatic omentum was found to be a mass of fat necrosis. The lesser peritoneal cavity was drained of blood-stained fluid and particles of necrotic tissue, and the man improved to a certain extent, but as he still continued to run a temperature, and as the disease had continued sufficiently long to have resulted in a good deal of fat necrosis, a secondary incision was made in the left loin for the purpose of additional drainage, and lumps of tissue were discharged. After the drainage was freed the patient was still profoundly anæmic, and free discharge persisted, but was diminishing.

In this case, which was still under observation, the disease seemed to be confined to the body and splenic end of the

pancreas, a considerable part of which had apparently necrosed. The patient was slowly improving. Dr. Hotchkiss said the only case of true hemorrhagic pancreatitis he had ever seen had proved fatal within two or three days, and he asked Dr. Tilton whether he regarded his case as one of true acute hemorrhagic pancreatitis, according to the usual classification of that disease.

DR. TILTON replied that he had based his diagnosis upon the character of the hemorrhagic fluid that he had found, especially in the lesser sac, as well as upon the extensive fat necrosis. The pancreas itself was soft and large, especially the head of the organ. The case was operated on at such an early stage that actual necrosis of the pancreas had not yet developed. Drainage did not result in bringing out any necrotic tissue.

Dr. Tilton thought it was not very unusual to have these cases recover, providing they were operated on sufficiently early. An early operation, too, prevented further necrosis.

DR. JOHN F. ERDMANN said he had seen four cases of hemorrhagic pancreatitis within the year. In two of them, upon which he operated, recovery took place. In the other two, where no operation was done, the diagnosis was made by the attending physicians and himself, and confirmed by autopsy. In both of the latter cases the patients were in a moribund condition, contraindicating operation. The patients were males, ranging from 45 to 50 years, and in all of them there was a history of gall-stones.

Dr. Erdmann said he had thus far reported ten cases of pancreatitis, seven of the hemorrhagic type; of the latter, five recovered after operation.

DR. MOSCHCOWITZ said that in operating for acute pancreatitis, he now tried to introduce his drainage through the gastrohepatic omentum, which he thought was preferable to the gastrocolic omentum, as it gave better access to the pancreas and afforded more efficient drainage. It was usually assumed, the speaker said, that a cholecystostomy was beneficial in these cases. About three years ago he saw a stout woman, who was suffering from what was supposed to be cholecystitis. At all events, her symptoms raised no suspicion of acute pancreatitis. When Dr. Moschcowitz first saw her she refused operation, but three days later, when he saw her again, she gave a distinct picture of acute pancreatitis. She was sent to the hospital,

and upon opening the abdomen he found the pancreas much enlarged, with numerous areas of fat necrosis. The gall-bladder was filled with calculi. He did a cholecystostomy, the gall-bladder was drained, and the patient, apparently, was on the road to complete recovery. On the day preceding her intended discharge he was hastily sent for, and found the woman in a state of collapse. Upon examination, a large mass was made out in the upper abdomen. He made a diagnosis of acute hemorrhage of the pancreas, which was verified upon operation.

DR. JOHN F. ERDMANN said that in one of his cases, the output of urine for twenty-four hours was submitted to Dr. Frederic E. Sondern for examination, and he reported that there was no Cammidge reaction. Subsequently, however, it was positive. In this case the pancreas showed fat necrosis plus hemorrhagic necrosis.

DR. GEORGE WOOLSEY said that from his own experience, as well as from what he had learned from the literature, it seemed to him that very many of these cases of acute pancreatitis could be saved, providing they were operated on sufficiently early. He was also inclined to believe that in the very acute cases a cholecystostomy had better be postponed until a later date, as these patients were usually very sick and could not well bear the strain of an additional operation. Incision and drainage would relieve a large number of these cases. With this treatment necrosis of the pancreas seldom occurs.

DR. MARTIN said that in a case which he operated on at a very early stage, about two years ago, he split the pancreas and instituted drainage. In spite of the early operation, necrosis occurred, and the entire pancreas sloughed away. The patient died in about three weeks.

DR. PECK said he had an experience similar to that recounted by Dr. Martin. The case was one of acute pancreatitis which he operated on within eight hours after its sudden onset. The patient died of necrosis.

CELLULITIS OF THE SPACE OF RETZIUS.

DR. A. V. MOSHCOWITZ said that at the last meeting of the Society, under the title of extensive pericystitis he had presented a man, 64 years old, who had suffered for the past seven years from symptoms of prostatic enlargement, and who, about four

weeks ago, had an attack of obstruction of urine for the relief of which he was aspirated by his physician. Immediately after this aspiration, the patient complained of severe abdominal pain; he became distended, vomited, and symptoms of a mild degree of ileus developed. All of these symptoms were overcome by medication, and the patient left the hospital within a few days.

He returned to the hospital on November 20, 1910, complaining of pain in the lower half of the abdomen, and examination showed a very firm, painful, and tender mass extending from the symphysis pubis to within two inches of the umbilicus. In general, this mass had somewhat the shape of a pregnant uterus, and it could be made out that it was intramural and not intraperitoneal.

After showing this case, Dr. Moschcowitz said, he poulticed the mass, and when fluctuation became apparent he made a small incision into it and evacuated six ounces of pus. It could be demonstrated with the finger that the mass was extraperitoneal. It was evidently a cellulitis of the space of Retzius, and probably resulted from an infection carried by the needle puncture which had been done to relieve the distended bladder.

DISINFECTION OF THE SKIN BY TINCTURE OF IODINE.

DR. CHARLES L. GIBSON read a paper with the above title, for which see page 106.

DR. JOHN A. HARTWELL said he had used this method of disinfection over the scalp, with very good results.

DR. KAMMERER said that for the past year he had been in the habit of giving the patient a bath on the evening preceding operation. No further preparation of the field of operation was necessary. On the operating table the skin where the incision was to be made was rubbed with ether and then painted with a single coating of the tincture of iodine. His results had been excellent.

A METHOD FOR THE PREPARATION OF CATGUT.

DR. A. V. MOSCHCOWITZ read a paper with the above title, for which see page 110.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held November 7, 1910.

The President, DR. ROBERT G. LE CONTE, in the Chair.

THE TECHNIC OF MEDIAN PERINEAL PROSTATECTOMY.

DR. SAMUEL ALEXANDER, of New York, by invitation, read a paper with the above title, for which see page 390.

THE TECHNIC OF SUPRAPUBIC PROSTATECTOMY.

DR. JOHN B. DEEVER, with reference to the technic of suprapubic prostatectomy, said that:

The technic of suprapubic prostatectomy commences in reality with the selection of the patient for operation. A patient, irrespective of age, good general health, good kidneys (in that they functionate normally, that is to say, excrete the normal amount of urine from the stand-point of the patient's age), with a large soft prostate, one that upon palpation with the finger in the rectum gives a sensation as if it were movable in its capsule, is a suitable case for operation.

He laid great stress upon the condition of the kidneys in the selection of his patients, and then preparation for operation. The patient must pass the normal amount of urine for a man at his time of life, considering that he must have more or less contraction of the kidneys, therefore the amount of urine must be larger than he had passed earlier in life. The speaker also laid stress upon the percentage of urea. He cared little if there is albumin, so long as it is not much, or if there are casts. He also considered carefully the condition of the bladder, its capacity, its tonicity, the amount of residual urine, the degree of cystitis if any, and the presence or not of a stone.

A cystoscopic examination should be made in certain cases, which will determine the condition of the bladder, the vesical aspect of the prostate, ureteral orifices, etc.

A bad cystitis should receive serious attention and is best handled by a retention catheter and bladder washings with boric acid, permanganate of potash, argyrol, etc. Culture of the urine to determine the micro-organism is essentially important. A few cases will not tolerate a permanent catheter, but will not be made worse by passing a catheter twice daily when the bladder can be irrigated. This will enable the operator to determine the class of cases in which he can close the bladder wound and that of the abdominal wall up to the drainage tube and thus prevent infection of the wound, which so often is a disagreeable factor; in this wise convalescence is hastened. A severe cystitis at the time of operation favors epididymitis; so does passing of sounds too soon after operation.

In the presence of high arterial tension as shown by the pulse, which is also often irregular, and the blood-pressure instrument, a course of nitroglycerine, the drinking freely of water, and in some cases proctoclysis are necessary to bring the case to a successful termination after operation.

The surgeon's anxiety and greatest responsibility only commence, as in many surgical operations, after the operation. Proper nursing at the hands of a gentle, kind, diplomatic, and experienced female nurse is important.

The operative technic involves the following elements:

Anæsthetic.—Ether is the only anæsthetic used in the speaker's clinic and he has no reason to think of using any other. Ether has always been perfectly satisfactory if properly given.

The anæsthetic may be given with the patient in the Trendelenburg position. The patient having been anæsthetized, an English catheter is passed into the bladder, followed by the introduction of two ounces of boracic or normal salt solution, catheter clamped with hæmostat.

Incision. Opening of bladder. Retractors. Inspection of bladder. Piece of gauze in the fundus of the bladder. Circular incision round internal meatus over prostate. Enucleation. Hemorrhage. Drainage.

Massage to coapt walls of bed of prostate. Small piece of gauze in perineal space to be removed in two days. Gauze in bed of prostate to control bleeding. Sterile rabbit serum if coagulation time is very slow. Can save prostatic urethra frequently.

Before recovery from anæsthetic, hypodermoclysis followed by proctoclysis.

After-treatment.—Avoid passing instruments through the urethra for three weeks, then simply to see if channel is unobstructed.

Stricture: Irregular margin of roof of bed of the prostate may be the cause of subsequent trouble. Two cases in speaker's experience requiring correction. Suspensory to be worn during convalescence.

After drainage tube is removed, wash out through suprapubic opening until it becomes too small to pass it, then introduction of simply the end of the nozzle of the tube into the external meatus and wash out bladder. This is sometimes required while the suprapubic wound is still large enough to wash out the bladder through this avenue, as when there are pus or shreds in the urine this affords means of thorough cleansing of the base of the bladder. The latter can be done through a soft catheter passed through the urethra into the bladder, but should not be used if avoidable, for fear of disturbing the healing process going on in the prostatic bed. Dr. Deaver said he had seen prevesical abscess, for which it may be necessary to incise the perineum.

DR. EDWARD MARTIN said that Dr. Alexander's work has received such universal acceptance that a discussion of his findings amounts to little more than a congratulatory appreciation. He had completely summarized the principle of enucleation of the prostate in the sentence "find the line of cleavage." That done, the operation is simple. He, however, had to confess a lack of confidence in surely striking that line when guided only by the sense of touch—he preferred to look in by a wider opening than is afforded by the median perineal route. Shock is, however, proportionate rather to the roughness and long continuance of manipulation than to the size of the wound. In men over fifty also comes the possibility of sexual incapacity being dependent on perineal trauma. The perineal route is more frequently followed by this disability than is the suprapubic. He had seen the same result follow the perineal operation for stone, and, in fact, almost any perineal operation, and believed that this impotence is in no wise due to damage to ducts, but is the result of extensive perineal trauma.

With regard to Dr. Deaver's remarks, it is perfectly true that the Trendelenburg position with proper illumination brings the operative field within the range of vision. He had devised a little light for these operations that goes into the bladder with a lateral retractor, so that until free bleeding occurs the base of the bladder and the urethra and urethral orifices are plainly seen. It is stated that Freyer always enters through the anterior commissure, he believing the line of cleavage to be most marked at this point.

DR. THOMAS R. NEILSON said that he was a firm believer in the selection of cases for operation. Some bad results can be prevented by being cautious as to those who are subjected to operation. The condition of the kidney, as well as of the bladder, should as nearly as possible be known, and any needed preliminary treatment given. After operation it is wise to pass sounds. This applies to either form of prostatectomy. It can do no harm, and may do much good.

Drainage of the prevesical space is a detail in the completion of the suprapubic operation which should not be omitted. In every suprapubic operation a small gauze drain should be placed there to prevent infection which might otherwise occur.

DR. HARRY DEAVER said that he had had some difficulty in controlling hemorrhage in these perineal operations, and he thought in suprapubic operations the hemorrhage to be more easily controlled. Cases may go on nicely for four or five days, then may be purged very freely and after that hemorrhage may occur. The bowels should be kept as quiet as possible until the vessels are entirely healed.

DR. SAMUEL ALEXANDER (in closing) said, with regard to the line of cleavage, that this point applies just as much in the suprapubic operation as in the perineal. This line of cleavage is clearer at the upper commissure than anywhere else, and any surgeon who studies the part of the prostate left as well as the part removed, will have no difficulty in reaching the same conclusion.

He did not claim any priority for any operative procedure, but simply emphasized the anatomical principles which underlie prostatectomy, whether this be done through the suprapubic or through the median perineal route. He agreed with Dr. Deaver that it is a matter of very little moment whether a part of the prostate is left behind or it is all taken out.

With regard to Dr. Deaver's remark that he had made no mention of bacteriology, he supposed was meant whether there exists a septic condition in the bladder or in the kidneys. He made no special preparation of his patient because the operation, as it is done, gives the very best treatment for septic conditions of the bladder that can be secured. If the bladder is opened and drained just as an abscess is opened, the best possible chance is given to recover itself; it does not matter whether the infection is streptococcic, staphylococcic, or gonorrhœal. The lowest possible level of access to the bladder is secured through the technic employed by him. The bladder is drained and then nature takes care of it.

Is it necessary to look into a bladder in order to see a prostatectomy? Many surgeons operate for appendicitis through a very small opening, separating adhesions with great skill, delivering the appendix, and then tying off, and have their patients recover. By practice and study of the prostate any one may become so proficient that he does not do a "blind" operation. He will be able to feel the line of cleavage just as he feels where the adhesions go in a laparotomy, can recognize the condition of the prostate just as that of the appendix, gall-bladder, or any other organ, and it is purely a matter of whether a man will take the pains to train himself as to which operation he will do. Of course, if one does not study the large number of museum specimens which are going to waste, if one will not take the trouble to dissect them intelligently, one will continue to do the open operation, but if one does study them one will learn so much more in regard to the prostate that the line of cleavage will become as simple as the Golden Rule.

In determining where to begin enucleation, cut the lateral lobe with scissors and feel down for the line of cleavage. The statement that the base of the prostatic tumors is covered by mucous membrane is not in accordance with anatomical facts, as can be shown by any longitudinal section of a prostate.

The advantage of the perineal operation is simply in the general surgical principle that in removing a growth from any place it should be gotten out by the shortest possible route, with the least damage to tissue and least danger of hemorrhage, and in this case the median perineal is the route to follow. The only reason it is not universally adopted is because men have

not taken the pains to study the pathological anatomy of the parts.

In regard to the bad results, Dr. Alexander did not feel any fear in reference to stricture as he did the operation. It is not his custom to pass any sound through the urethra until several weeks afterward. He then passed a sound in order to see that the urethra is all right. In this operation the mucous membrane is entirely preserved around and outside the urethral orifice. It is not necessary to preserve the urethra, but to prevent stricture it is necessary to preserve a perfect smooth mucous membrane about the urethra, and that is always the case in a properly performed perineal urethrotomy.

BOOK REVIEWS.

A TREATISE ON ORTHOPÆDIC SURGERY. By ROYAL WHITMAN, M.D., New York. Fourth edition. Lea and Febiger, Philadelphia and New York, 1910.

Orthopædic surgery has departed somewhat from its ancient practice, and now aims at the prevention of deformity as well as the treatment. In order to accomplish this, it has been necessary to study the causes of diseases which produce deformity, and direct the treatment to their prevention. Thus tuberculosis of joints is now recognized in its early stage, and healing often secured before deforming disease has developed. The next step to be hoped for is a social one, in which the industrial and economic conditions, lying at the root of such diseases, shall be corrected.

This book of Dr. Whitman's, since its first edition, has been regarded as a standard exposition of orthopædic surgery. The last edition brings it up to date. There are many noteworthy features. The text is full but not redundant. The description of the physical examination for tuberculosis of the spine may be cited as an admirable example of the surgical literature which should be found in a treatise of this sort. Under the head of diagnosis of this disease we find the following true and pathetic statement: "If a careful physical examination were made in all suspicious cases, by one at all familiar with the ordinary symptoms of Pott's disease, the field for differential diagnosis would be small indeed; but it would appear that such examinations are not made usually by the physician who is first consulted. One may learn, for example, that the child has been circumcised because of pain about the genitals, or because of weakness of the limbs, supposed to be due to 'reflex irritation'; or if the patient is an adult, that he has been treated for sciatica, rheumatism, or strain, long after the deformity, even, would have been apparent had the back been inspected."

Differential diagnosis of this disease is well presented. The method of applying plaster-of-Paris jackets is presented so that one gets a practical clinical picture. In cases of emergency, it is advised that retropharyngeal abscesses may be opened by an incision in the middle line of the pharynx, but preferably it should be opened through the side of the neck. The author

uses the word "costotransversectomy" to designate resection of the joint between the rib and transverse process. We are of the opinion that the learned author would not defend this bad word.

Though describing and recommending the more conservative measures, the impression is given that the author is more inclined to the incision of tuberculous abscess of the spine than is the present practice among surgeons. Dr. Gould, at least, would object to the omission of eye-strain as a cause of curvature.

Truslow is quoted as stating that investigation shows that in a large proportion of cases of curvature the patients had led sedentary lives and did not enjoy exercise. The exercises and manipulations for correction are fully described. Teschner's exercises are quoted from the *ANNALS OF SURGERY*. The classic treatment of kyphosis and lordosis is given.

The discussion of cervical ribs is brief, but, perhaps, as full as a work of this scope should give. Wolff's law, concerning changes in the form and function of bones, is fully described.

The essentials of Bier's hyperæmic treatment are given, but tuberculin is not spoken of. The description of the treatment of infections by means of vaccines is inadequate for a work published in 1910. It seems also to the reviewer that the treatment of non-tuberculous diseases of joints might have been given somewhat more in detail. If hæmophilia is worthy of being described, some word concerning its modern treatment might have been introduced.

That America was the cradle of orthopædic surgery is contradicted by the references to Thomas's early work. When American surgeons generally believed that motion was necessary in the treatment of joint diseases in order to prevent ankylosis, Thomas, of Liverpool, showed that immobilization was the best treatment for hip disease. Thomas is given full credit for his important work.

Lorenz is freely alluded to in the discussion of congenital dislocation of the hip. The description of the pathology and etiology of coxa vara is succinct. The diagnosis and treatment are admirable. The advantages of cuneiform osteotomy are well presented. The illustrations, showing the advantage of treating fracture of the neck of the femur by extreme abduction, are convincing.

Flexner's work upon anterior poliomyelitis is referred to.

Perhaps more of the distinctly medical side of this disease is given than one would expect to find in a book on orthopædic surgery. The treatment of the paralyses and the paralytic sequelæ is good. Hoffa's operation for paralysis of the deltoid, by transplantation of the trapezius, is given.

Anterior metatarsalgia is well described. Morton's operation, the author says, is as a rule successful, but in the majority of cases it is unnecessary. The treatment of ingrown toe-nail is confined to a single operation, that of Webb, by means of silver wire placed under and around the nail. This method evidently has proved sufficient in the hands of the author.

The sane discussion of shoes, which this work presents, might wisely be read by every layman. Much social good would accrue if it could be distributed widely as a tract.

The treatment of club-foot by stretching, so warmly advocated and so forcibly applied by Lorenz, is well presented. It is here that the German and Austrian surgeons have excelled. Great good is accomplished whenever the orthopædist declares his appreciation of the susceptibility of the soft tissues to the influence of stretching. "*Man hat in der Orthopädie viel zu wenig mit der Elasticität der Theile gerechnet.*"

J. P. WARBASSE.

DISEASES OF THE COLON. By P. LOCKHART MUMMERY, F.R.C.S. 322 pages, illustrated. John Wright & Sons, Ltd., 1910.

This work, founded on the Jacksonian essay for 1909, is timely because of the greater frequency of pathologic conditions of the large intestine which have developed during the past few years, consequent in some measure, certainly, to the introduction of the modern diet of prepared foods, and to an increase in the number of people employed in sedentary occupations; both factors inhibiting most markedly the stimuli to peristalsis, and thus giving rise to the most potent factor in the etiology of disturbances of the large intestine. Such a book is the more welcome because it serves to classify and correlate the very rapid strides which the diagnoses and treatment of these conditions have taken.

It is difficult to classify the book, as it falls far short of being encyclopædic in its scope, and, on the other hand, is not monographic in its detail. Throughout is to be noted a very meagre bibliography, and but seldom is mention made of ex-

tensive consideration by contemporary authors of the subject in hand. The American literature suffers particularly in this respect, although the work of Cannon and others is deservedly mentioned and accredited under the chapter of physiology.

After the rather brief chapters on physiology, bacteriology, etc., the author considers the congenital abnormalities of the colon, chiefly dilatation, and introduces the operation of appendicostomy for its relief, quoting a successful case; this certainly deserves consideration.

This is succeeded by a good presentation of volvulus of the colon; but the following chapter on adhesions and kinking of the colon is rather defective in the consideration of their treatment.

Chapter IX takes up inadequately the X-ray diagnosis of colonic malpositions, and no mention is made at all of the stenoses consequent to carcinomata, or the presence of diverticula. In considering the subject of pericolicitis, the presence of diverticula is mentioned as its etiologic factor in some cases. The confused ideas of the author regarding the etiology in cases of cancer occurring in conjunction with diverticula is noticed on page 195. Reference to contemporaneous American literature would, we feel, have served to eliminate the rather indefinite position taken on this question.

We are glad to note the author's ideas on the treatment of chronic constipation, particularly inasmuch as they are not in accord with those writers who regard the colon as of small importance to the bodily economy. The author deprecates the operation for its relief as practised by some, namely, that of resection of the colon with its consequent 33 per cent. mortality. Doubtless there are a few cases in which this procedure may seem indicated, but they must be extremely rare, and the reviewer fully agrees that the more simple one of appendicostomy should at least be given a thorough trial.

The chapters dealing with tuberculosis, simple stricture, embolism of the mesocolic vessels, cancer, colotomy, and the various other operations on the colon, while good to a degree, are, on the other hand, disappointing in the very noticeable deficit of details.

The book is admirably written, but it cannot be considered in any way a complete résumé of our present-day knowledge in this department of medicine and surgery.

APPLIED ANATOMY—THE CONSTRUCTION OF THE HUMAN BODY CONSIDERED IN RELATION TO ITS FUNCTIONS, DISEASES, AND INJURIES. By GWILYM G. DAVIS, Associate Professor of Applied Anatomy in the University of Pennsylvania. With six hundred and thirty illustrations, mostly from original dissections and many in color by Erwin F. Faber. Philadelphia and London: J. B. Lippincott Company.

The author presents for consideration a volume of six hundred and thirty pages with six hundred and thirty illustrations.

The subject is treated regionally, according to the usual anatomic divisions. The morphology and function of each part is briefly described and followed by a consideration of the surface anatomy.

Next the author considers the various affections of the part, correlating anatomical and clinical facts in such a practical way that the applied anatomical facts are clothed with a new and vital interest.

The value of the work is further increased by indicating the anatomical principles involved in the diagnosis and treatment of the affected part. The mechanism of dislocations and their reduction is fully described; the rationale of the principal operative procedures is given, and the classical ligations, amputations, and excisions receive a consideration perhaps in excess of their relative importance.

The illustrations in this work are of unusual excellence, and for the most part original. Many of the dissections have been reproduced in color. All are pertinent and show commendable care in selection and execution.

Anatomically, clinically and artistically this work is thoroughly satisfactory.

WILLIAM FRANCIS CAMPBELL.

ANNALS OF SURGERY

VOL. LIII

APRIL, 1911

No. 4

ORIGINAL MEMOIRS.

INJURY AS A CAUSATIVE FACTOR IN CANCER.*

BY WILLIAM B. COLEY, M.D.,
OF NEW YORK,

Professor of Clinical Surgery, Cornell University Medical College; Attending Surgeon to
the General Memorial Hospital for the Treatment of Cancer and Allied Diseases;
Attending Surgeon to the Hospital for Ruptured and Crippled.

THAT injury or trauma plays an important part in the development of all types of malignant tumors has been recognized by the laity from the earliest times. The question of the causative relationship between trauma and cancer has not until recently received the careful scientific investigation which its importance demands. At the French Congress of Surgery, 1907, it formed the chief topic of discussion, and at the recent International Cancer Research Congress of Paris, Oct. 5, 1910, two of the principal papers of the congress were devoted to it.

The most recent paper upon the subject in America is Phelps's article in the ANNALS OF SURGERY, May, 1910; it is an elaborate attempt to prove that trauma has no influence whatever upon the development of cancer (he limits the use of the word "cancer" to carcinoma). He admits that a "popular belief that a cancer of the breast can always be traced to some contusion or other trivial injury has existed to a very great extent," and he believes this profound belief "has been held with a tenacity which has hypnotized attending physicians into accepting impossible assertions as undoubted facts."

* Read before the Southern Surgical and Gynecological Association at Nashville, Tenn., December 15, 1910.

In passing, it may be worth noting that popular beliefs of such long standing and so deeply rooted have, almost invariably, been proven in the end to be founded upon facts.

Phelps has attempted to answer the question, not by adding any new data based upon personal observations, but upon an analysis of opinions of other men, dating back as far as the earliest history of cancer. He states that he has no records of histories of cancer cases that have come under his own care.

Phelps at the outset states that he uses the word "cancer" to include only carcinoma and not sarcoma. I believe it better to use the word "cancer" to include all forms of malignant tumors, both of epithelial and connective-tissue origin, for the reason that up to comparatively recent times "cancer" was universally used in this broad, general way, both by the laity and the profession. We certainly need some word to include all types of malignant tumors, and no better term could be found than the word "cancer." Still further, the word "cancer" is at the present time used to include all malignant tumors by all the workers in cancer research throughout the world. So, then, in dealing with the question of trauma as a causative factor in malignant tumors, we shall consider all types of cancer. A careful study of all the varying types of malignant disease shows practically the same apparent causative influence from injury, although the percentage of cases associated with antecedent trauma may be slightly greater in sarcoma than carcinoma. But numerous cases of so-called acute traumatic malignancy will be found in all types.

The question cannot be settled by any review of old statistics, especially of hospital statistics taken by a house officer just beginning his experience in history-taking and usually following the routine custom handed down from previous generations of house surgeons. The only way the matter can be settled even approximately is by careful records of either a large number of personal observations or, better still, by the records of a large cancer hospital in which careful and uniform histories have been kept over a long period of years. Such records are, unfortunately, at the present time not in existence. The number of cases of cancer at any general hospital is too

small to give the required data without going back over a long period of years, too far to insure uniform methods in history-taking, and hence of little value in connection with such a question. Therefore, at present we must still rely on the results of large personal experiences, carefully and uniformly recorded. For the reason that 20 years ago I began to make special investigations in sarcoma, my opportunities for a study of this type of cancer have been unusually large, and it is the result of this personal experience, particularly in reference to the association of trauma and sarcoma, that I desire to place before you at this meeting. (My cases are all from histories taken myself.

Up to November 24, 1897, I had had under my care 170 cases of sarcoma and had careful histories of these cases. In a paper entitled "The Influence of Injury upon the Development of Sarcoma," read before the New York Surgical Society in November, 1897 (*ANNALS OF SURGERY*, March, 1898), I said that "no clinical feature of the disease had impressed me more strongly than the frequent association of trauma with its early manifestations." I started out with no theory to prove, but with an impartial mind, and I did not write my paper until I had personally seen 46 cases of antecedent trauma in a total of 170 cases of sarcoma observed. In that paper I gave a detailed history of each of these cases, and while in some the interval elapsing between injury and the development of the tumor was sufficiently long to justify some doubt as to any causative relationship, in most cases it was so short, that to rule it out as a coincidence without causative relationship would be begging the question.

In 9 of the 46 cases the tumor developed within one week following the injury at the exact site of injury.

Since writing this paper, I have observed 800 additional cases of sarcoma, making a total of 970 cases, and of the 800 new cases a definite history of trauma was noted in 179 cases; or in the entire series of 970 cases, 225 times, or 23 per cent. The tumor developed within the first month after the injury in 117 of the 225 cases, 52 per cent., of typical acute traumatic malignancy, the reality of which Phelps and others deny.

These cases are very briefly enumerated in the following tables. A number of the more important ones are given in greater detail in the body of the paper.

TABLE I.

SYNOPSIS OF CASES PREVIOUSLY PUBLISHED.¹

Case 1.—Age 18; female. Round-celled sarcoma. Site of tumor, metacarpal bone. Injury by blow. Interval between injury and appearance of tumor, at once.

Case 2.—Age 28; female. Round-celled sarcoma. Site of tumor, spine. Injury by fall. Interval between injury and appearance of tumor, 1 year.

Case 3.—Age 37; male. Melanotic sarcoma. Site of tumor, thumb. Injury by contusion. Interval between injury and appearance of tumor, at once.

Case 4.—Age 7; female. Mixed-celled sarcoma. Site of tumor, ovary. Injury by fall. Interval between injury and appearance of tumor, 2 months.

Case 5.—Age 55; female. Cylindroma. (Sarcoma.) Site of tumor, breast. Injury by blow. Interval between injury and appearance of tumor, 1 week.

Case 6.—Age 25; male. Round-celled sarcoma. Site of tumor, testis. Injury by blow. Interval between injury and appearance of tumor, 2 years.

Case 7.—Age 11; male. Round-celled sarcoma. Site of tumor, thigh (popliteal space). Injury by blow. Interval between injury and appearance of tumor, less than 1 year.

Case 8.—Age 59; male. Angiosarcoma. Site of tumor, breast. Injury by blow. Interval between injury and appearance of tumor, 3 months.

Case 9.—Age 41; female. Round-celled sarcoma. Site of tumor, arm. Injury by blow. Interval between injury and appearance of tumor, 2 years.

Case 10.—Age 46; female. Melanotic sarcoma. Site of tumor, neck. Injury by scratch. Interval between injury and appearance of tumor, soon.

Case 11.—Age 8; female. Round-celled sarcoma. Site of tumor, chest. Injury by blow. Interval between injury and appearance of tumor, 6 weeks.

Case 12.—Age 43; male. Round-celled sarcoma. Site of tumor, mastoid. Injury by severe blow. Interval between injury and appearance of tumor, 4½ years.

Case 13.—Age 20; female. Spindle-celled sarcoma. Site of tumor, hand. Injury by fall. Interval between injury and appearance of tumor, 1 year.

Case 14.—Age 31; female. Round-celled sarcoma. Site of tumor, breast. Injury by blow. Interval between injury and appearance of tumor, few days.

¹ ANNALS OF SURGERY, March, 1898.

Case 15.—Age 31; female. Site of tumor, breast. Injury by blow. Interval between injury and appearance of tumor, few days.

Case 16.—Age 11; female. Spindle-celled sarcoma. Site of tumor, femur. Injury by fall. Interval between injury and appearance of tumor, at once.

Case 17.—Age 26; female. Round-celled sarcoma. Site of tumor, femur. Injury by sprain. Interval between injury and appearance of tumor, 1 to 2 years.

Case 18.—Age 48; female. Spindle-celled sarcoma. Site of tumor, thigh. Injury by strain (muscular). Interval between injury and appearance of tumor, 2 years.

Case 19.—Age 29; male. Round-celled sarcoma. Site of tumor, testis. Injury by fall. Interval between injury and appearance of tumor, 3 to 4 weeks.

Case 20.—Age 22; male. Round-celled sarcoma. Site of tumor, testis. Injury by fall and contusion. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 21.—Age 27; female. Round-celled sarcoma. Site of tumor, axilla. Injury by laceration (finger). Interval between injury and appearance of tumor, 1 week.

Case 22.—Age 55; male. Mixed-celled sarcoma. Site of tumor, parotid. Injury by blow. Interval between injury and appearance of tumor, 4 to 6 weeks.

Case 23.—Age 11; female. Round-celled sarcoma. Site of tumor, calf of leg. Injury by fall. Interval between injury and appearance of tumor, 2 to 3 months.

Case 24.—Age 14; male. Round-celled sarcoma. Site of tumor, ribs. Injury by blow. Interval between injury and appearance of tumor, 6 months.

Case 25.—Age 53; male. Mixed-celled sarcoma. Site of tumor, parotid. Injury by blow. Interval between injury and appearance of tumor, 5 years.

Case 26.—Age 14; male. Osteosarcoma. Site of tumor, ilium. Injury by contusion. Interval between injury and appearance of tumor, 1½ years.

Case 27.—Age 30; male. Round-celled sarcoma. Site of tumor, clavicle. Injury by fracture. Interval between injury and appearance of tumor, 1½ years.

Case 28.—Age 26; male. Round-celled sarcoma. Site of tumor, femur. Injury by sprain. Interval between injury and appearance of tumor, few weeks.

Case 29.—Age 55; male. Round-celled sarcoma (myxosarcoma). Site of tumor, thigh. Injury by gun-shot wound. Interval between injury and appearance of tumor, 25 years.

Case 30.—Age 27; female. Round-celled sarcoma. Site of tumor, breast. Injury by burn (carbolic acid). Interval between injury and appearance of tumor, 3 months.

Case 31.—Age 36; male. Osteochondroma sarcoma. Site of tumor,

shoulder. Injury by sprain. Interval between injury and appearance of tumor, 6 months.

Case 32.—Age 30; female. Osteochondroma sarcoma. Site of tumor, ilium. Injury by fall. Interval between injury and appearance of tumor, 3 months.

Case 33.—Age 38; female. Osteochondroma sarcoma. Site of tumor, lower jaw. Injury by blow. Interval between injury and appearance of tumor, few weeks.

Case 34.—Age 29; male. Mixed-celled sarcoma. Site of tumor, eye. Injury by scratch. Interval between injury and appearance of tumor, few weeks.

Case 35.—Age 55; male. Round-celled sarcoma (melanotic). Site of tumor, ball of foot. Injury by laceration from nail in shoe. Interval between injury and appearance of tumor, few weeks.

Case 36.—Age 12; male. Round-celled sarcoma. Site of tumor, tibia. Injury by fall. Interval between injury and appearance of tumor, 2 months.

Case 37.—Age 5; female. Round-celled sarcoma. Site of tumor, femur. Injury of old fracture. Interval between injury and appearance of tumor, 1 to 2 years.

Case 38.—Age 24; female. Round-celled sarcoma (melanotic). Site of tumor, tibia. Injury by fall. Interval between injury and appearance of tumor, at once.

Case 39.—Age 16; female. Spindle-celled sarcoma. Site of tumor, foot. Injury by fall. Interval between injury and appearance of tumor, few weeks.

Case 40.—Age 26; male. Round-celled sarcoma. Site of tumor, tibia. Injury by blow. Interval between injury and appearance of tumor, few weeks.

Case 41.—Age 50; male. Round-celled sarcoma. Site of tumor, kidney. Injury by fall and contusion. Interval between injury and appearance of tumor, 6 months.

Case 42.—Age 40; male. Spindle-celled sarcoma. Site of tumor, parotid. Injury by blow. Interval between injury and appearance of tumor, few months.

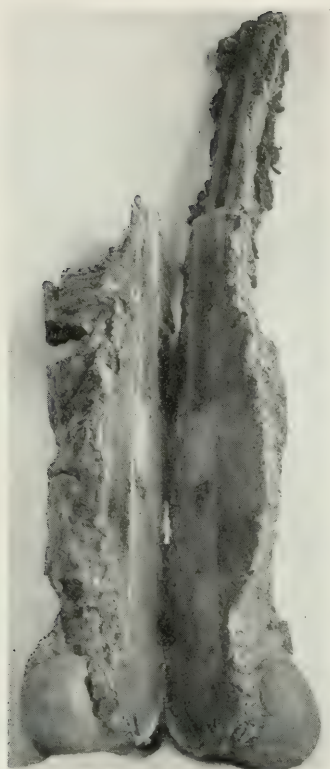
Case 43.—Age 39; female. Melanotic sarcoma. Site of tumor, foot. Injury by contusion. Interval between injury and appearance of tumor, few weeks.

Case 44.—Age 50; female. Melanotic sarcoma. Site of tumor, leg. Injury by scratch. Interval between injury and appearance of tumor, few days.

Case 45.—Age 73; male. Round-celled sarcoma. Site of tumor, tonsil. Injury by contusion. Interval between injury and appearance of tumor, 5 days.

Case 46.—Age 23; female. Osteochondroma sarcoma. Site of tumor, ilium. Injury by fall. Interval between injury and appearance of tumor, 2 injuries, 1 ten years, 1 two years before.

FIG. 1.



Periosteal round-celled sarcoma; appeared 2-3 weeks after sprain. (Case 28, Table I.)

FIG. 2.



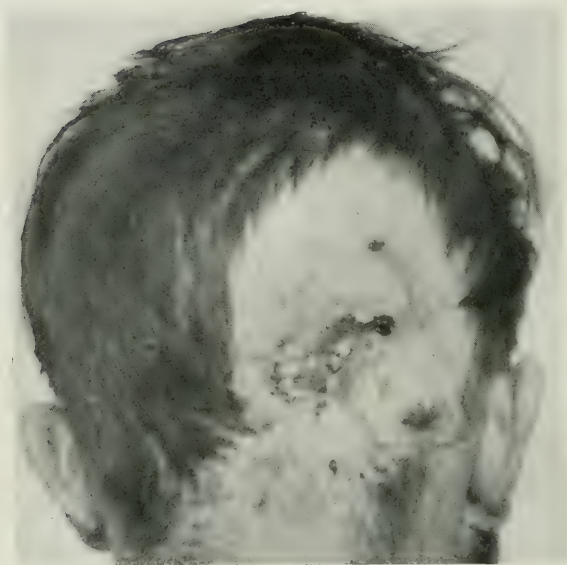
Sarcoma of femur (following trauma). Amputation of hip-joint. (Case 37, Table I.)

FIG. 5.



Sarcoma of upper end of femur. First noticed 3 weeks after fall from tree. (Case 4, Table II.)

FIG. 4.



Fibroma, later changing to fibrosarcoma, finally causing death.
Followed blow on back of head by baseball bat.

FIG. 5.



Sarcoma of forehead; developed 2-3 weeks after blow against sharp corner of bureau. (Case 49, Table II.)

FIG. 6.



Simple spiral fracture of humerus. X-ray taken through plaster splint, a few days after injury.

FIG. 7.



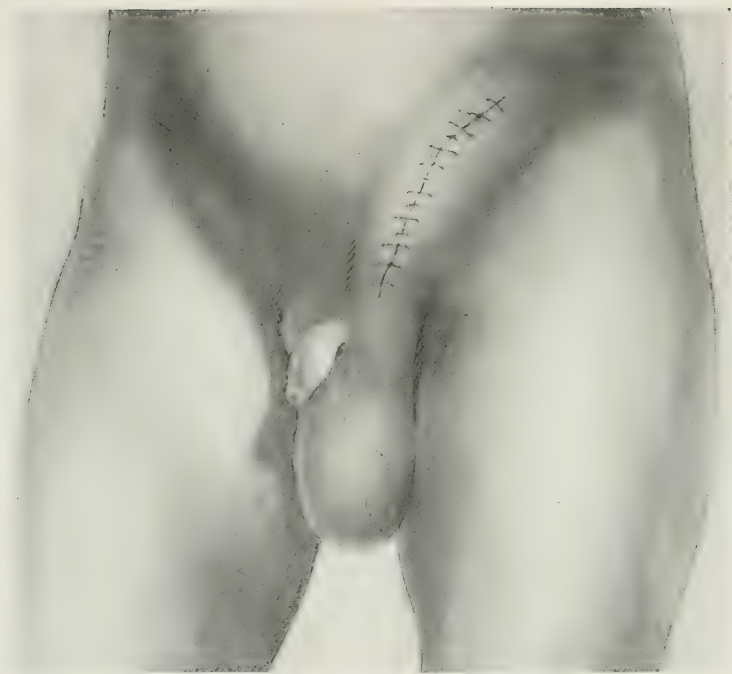
Same case, showing well-developed sarcoma at site of fracture. X-ray taken 2 months later.

FIG. 8.



Same case after 4 months' treatment with the mixed toxins of erysipelas and *Bacillus prodigiosus*. Almost complete disappearance of the tumor. New formation of bone and reunion of pathological fracture.

FIG. 9.



Round-celled sarcoma originating in scar (cicatrix) of a hernia operation, within 4 weeks after operation. Associated with a sarcoma of upper jaw, occurring just before. Caused death in three months.

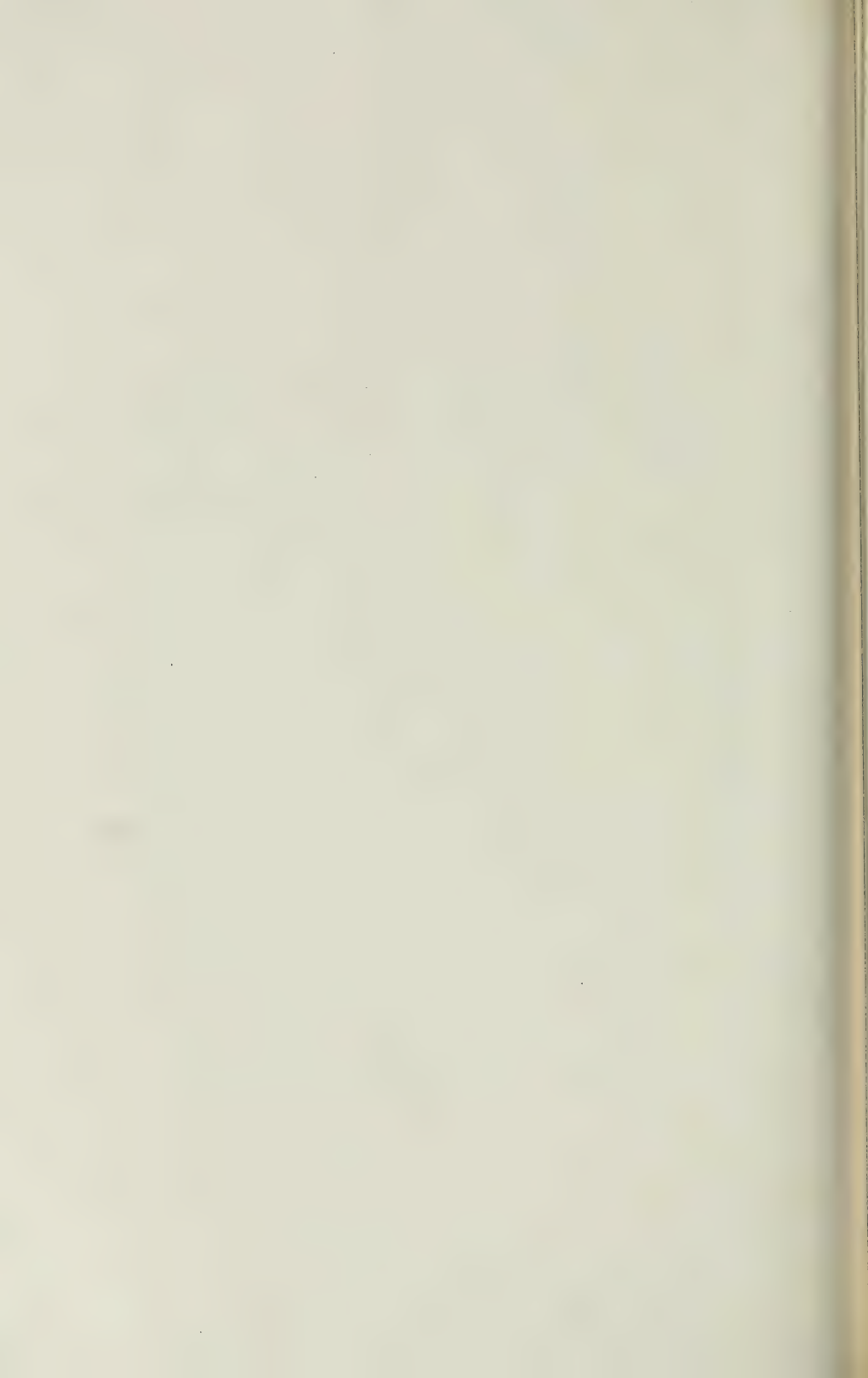


TABLE II.

CASES OF SARCOMA WITH ANTECEDENT TRAUMA, PERSONALLY OBSERVED
SINCE 1898.

Case 1.—H. C., age 15; male. (1909.) Site of tumor, ribs. Character of injury, run over by carriage. Interval between injury and appearance of tumor, 3 months.

Case 2.—M. D., age 10; female. (1902.) Site of tumor, skull. Character of injury, blow from stone thrown by boy. Interval between injury and appearance of tumor, 2 months.

Case 3.—W. D., age 15; female. (1907.) Site of tumor, scrotum. Character of injury, fall from bicycle. Interval between injury and appearance of tumor, few weeks.

Case 4.—D., age 16; male. (1907.) Site of tumor, femur. Character of injury, fall from tree. Interval between injury and appearance of tumor, 3 weeks.

Case 5.—E., age 29; male. (1904.) Site of tumor, scalp, head. Character of injury, struck by baseball bat. Interval between injury and appearance of tumor, 2 years. Fibroma, changing to sarcoma.

Case 6.—F., age 35; female. (1906.) Site of tumor, cheek. Character of injury, mole tied off with silk. Interval between injury and appearance of tumor, few days. Melanotic.

Case 7.—F., age 45; female. (1906.) Site of tumor, forearm. Character of injury, blow (bruise). Interval between injury and appearance of tumor, 2 to 3 weeks. Round-celled.

Case 8.—F., age 41; female. (1896.) Site of tumor, humerus. Character of injury, struck with rake handle. Interval between injury and appearance of tumor, 2 years. Round-celled.

Case 9.—F., age 26; female. (1908.) Site of tumor, radius. Character of injury, fall. Interval between injury and appearance of tumor, 1st, 3 years; 2d, 2 to 8 weeks. Round-celled, central.

Case 10.—F., age 24; female. (1906.) Site of tumor, ulna. Character of injury, blow, contusion. Interval between injury and appearance of tumor, 1 month.

Case 11.—S., age 52; female. (1898.) Site of tumor, fibula. Character of injury, fall. Interval between injury and appearance of tumor, 3 months.

Case 12.—H., age 56; male. (1898.) Site of tumor, heel. Character of injury, from nail in shoe. Interval between injury and appearance of tumor, few months. Round-celled, melanotic.

Case 13.—F., age 47; male. (1908.) Site of tumor, heel. Character of injury, blister from shoe. Interval between injury and appearance of tumor, few days. Melanotic.

Case 14.—B., age 28; female. (1901.) Site of tumor, thigh. Character of injury, fall from bicycle. Interval between injury and appearance of tumor, 2 years.

Case 15.—B., age 60; female. (1905.) Site of tumor, neck. Character of injury, strain. Interval between injury and appearance of tumor, few days.

Case 16.—S., age 47; female. Site of tumor, thigh. Character of injury, struck by sharp corner of marble-top table. Interval between injury and appearance of tumor, 1 year.

Case 17.—B., age 12; male. (1908.) Site of tumor, ilium. Character of injury, struck by baseball bat. Interval between injury and appearance of tumor, 5 months.

Case 18.—B., age 25; male. (1899.) Site of tumor, superior maxilla. Character of injury, fall from bicycle. Interval between injury and appearance of tumor, 4 months.

Case 19.—B., age 51; male. (1889.) Site of tumor, thumb. Character of injury, blow. Interval between injury and appearance of tumor, few months.

Case 20.—B., age 65; female. (1895.) Site of tumor, orbit. Character of injury, blow. Interval between injury and appearance of tumor, few months.

Case 21.—A., age 31; male. (1895.) Site of tumor, testis. Character of injury, 2 severe injuries to same testis. Interval between injury and appearance of tumor, 1st, 10 years; 2d, 9 years.

Case 22.—B., age 36; female. (1898.) Site of tumor, foot. Character of injury, stepped on by horse, severe bruise. Interval between injury and appearance of tumor, 2 to 3 months.

Case 23.—A., age 43; male. (1903.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, few days.

Case 24.—A., age 26; male. (1902.) Site of tumor, forearm. Character of injury, severe strain getting off car. Interval between injury and appearance of tumor, 3 months.

Case 25.—R., age 41; female. (1906.) Site of tumor, ear. Character of injury, blow. Interval between injury and appearance of tumor, few days. Pigmented mole; melanotic sarcoma.

Case 26.—A., age 44; male. (1901.) Site of tumor, mesenteric glands. Character of injury, severe contusion of abdomen. Interval between injury and appearance of tumor, symptoms directly after injury. Tumor few months. Round-celled.

Case 27.—G., age 35; male. (1909.) Site of tumor, femur. Character of injury, fall, bruise. Interval between injury and appearance of tumor, few days—1 week.

Case 28.—N., age 24; male. (1904.) Site of tumor, testis. Character of injury, blow. Interval between injury and appearance of tumor, 7 weeks.

Case 29.—S., age 51; male. (1907.) Site of tumor, superior maxilla. Character of injury, blow, struck by piece of timber. Interval between injury and appearance of tumor, 5 months.

Case 30.—W., age 28; male. (1909.) Site of tumor, femur. Character of injury, contusion. Interval between injury and appearance of tumor, 5 months.

Case 31.—G., age 6½; male. (1899.) Site of tumor, hand. Character of injury, fall, bruise. Interval between injury and appearance of tumor, few days. Spindle-celled.

Case 32.—G., age 42, male. (1901.) Site of tumor, testis. Character of injury, blow, contusion. Interval between injury and appearance of tumor, few days.

Case 33.—G., age 45; female. (1905.) Site of tumor, calf of leg. Character of injury, injured pigmented mole while riding. Interval between injury and appearance of tumor, few days. Melanotic.

Case 34.—G., age 48; male. (1908.) Site of tumor, testis. Character of injury, contusion, riding horseback. Interval between injury and appearance of tumor, few days.

Case 35.—H., age 28; male. (1902.) Site of tumor, superior maxilla. Character of injury, thrown from carriage, contusion. Interval between injury and appearance of tumor, 2 years.

Case 36.—G., age 14; male. (1906.) Site of tumor, ilium. Character of injury, fell down stairs; injury to left shoulder; 1 year later, fell down again. Interval between injury and appearance of tumor, few weeks after second injury.

Case 37.—V., age 42; female. (1900.) Site of tumor, thigh. Character of injury, ran against door, contusion. Interval between injury and appearance of tumor, 6 weeks.

Case 38.—V., age 28; male. (1904.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, few weeks. Round-celled.

Case 39.—T., age 39; male. (1909.) Site of tumor, scapular region. Character of injury, severe contusion. Interval between injury and appearance of tumor, 1 month. Round-celled.

Case 40.—R., age 25; male. (1906.) Site of tumor, ilium. Character of injury, fall. Interval between injury and appearance of tumor, 10 years.

Case 41.—F., age 43; female. (1905.) Site of tumor, retroperitoneum. Character of injury, fall. Interval between injury and appearance of tumor, 8 years.

Case 42.—F., age 29; male. (1908.) Site of tumor, pectoral region. Character of injury, strain of pectoral muscle. Interval between injury and appearance of tumor, soon.

Case 43.—M., age 40; male. (1907.) Site of tumor, little toe. Character of injury, run over by auto. Interval between injury and appearance of tumor, few days later.

Case 44.—H., age 45; male. Site of tumor, face. Character of injury, applied caustic to pigmented mole. Interval between injury and appearance of tumor, few days. Melanotic.

Case 45.—H., age 8; female. (1895.) Site of tumor, face. Character of injury, severe slap on face. Interval between injury and appearance of tumor, 6 weeks later.

Case 46.—S., age 42; male. (1905.) Site of tumor, femur. Character of injury, severe wrench of knee. Interval between injury and appearance of tumor, 10 months.

Case 47.—T., age 39; male. (1899.) Site of tumor, thigh. Character of injury, run over by truck. Interval between injury and appearance of tumor, 6 months.

Case 48.—T., age 46; male. (1904.) Site of tumor, testis. Character of injury, fell astride barrel, injuring right testis when boy. Interval between injury and appearance of tumor, 25 years.

Case 49.—T., age 60; female. (1907.) Site of tumor, forehead, frontal bone. Character of injury, struck forehead against sharp corner of bureau. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 50.—V., age 33; male. (1906.) Site of tumor, tibia. Character of injury, twist of knee. Interval between injury and appearance of tumor, 10 months.

Case 51.—T., age 45; male. (1906.) Site of tumor, ulna. Character of injury, severe strain (twist). Interval between injury and appearance of tumor, few weeks.

Case 52.—S., age 21; male. (1908.) Site of tumor, forearm. Character of injury, blow, football. Interval between injury and appearance of tumor, few weeks.

Case 53.—S., age 50; female. (1893.) Site of tumor, gluteal region. Character of injury, fall, striking buttock on edge of board. Interval between injury and appearance of tumor, few days (1 week).

Case 54.—S., age 51; male. (1906.) Site of tumor, gluteal region. Character of injury, trauma to pigmented mole. Interval between injury and appearance of tumor, at once. Melanotic sarcoma.

Case 55.—S., age 10; male. (1901.) Site of tumor, ilium. Character of injury, fall down stairs. Interval between injury and appearance of tumor, 1 month.

Case 56.—S., age 53; male. (1897.) Site of tumor, parotid. Character of injury, blow. Interval between injury and appearance of tumor, 5 years.

Case 57.—S., age 32; male. (1907.) Site of tumor, ilium. Character of injury, fall. Interval between injury and appearance of tumor, 8 months.

Case 58.—C., age 15; male. (1909.) Site of tumor, femur. Character of injury, fell 30 feet; 2 years later second fall, fracturing femur; sarcoma developed in callus. Interval between injury and appearance of tumor, 2 months. Round-celled.

Case 59.—S., age 21; male. (1893.) Site of tumor, clavicle. Character of injury, fracture. Interval between injury and appearance of tumor, 1 year. Round-celled.

Case 60.—C., age 55; female. (1908.) Site of tumor, femur. Character of injury, blow. Interval between injury and appearance of tumor, soon; few weeks. Large spindle- and giant-celled.

Case 61.—C., age 27; male. (1901.) Site of tumor, thigh. Character of injury, blow playing baseball. Interval between injury and appearance of tumor, 2 months.

Case 62.—C., age 10; male. (1909.) Site of tumor, tibia. Character of injury, bruise (blow). Interval between injury and appearance of tumor, 8 months.

Case 63.—C., age 37; male. (1908.) Site of tumor, pectoral region. Character of injury, strain of muscle. Interval between injury and appearance of tumor, few days later.

Case 64.—C., age 30; male. (1904.) Site of tumor, thigh. Character of injury, blow. Interval between injury and appearance of tumor, soon; 2 to 3 weeks.

Case 65.—C., age 23; male. (1907.) Site of tumor, thigh. Character of injury, pigmented mole tied off with silk. Interval between injury and appearance of tumor, few days. Melanotic.

Case 66.—H., age 20; male. (1906.) Site of tumor, tibia. Character of injury, sprain. Interval between injury and appearance of tumor, soon, few weeks. Round-celled, periosteal.

Case 67.—H., age 42; male. (1907.) Site of tumor, kidney. Character of injury, kick. Interval between injury and appearance of tumor, 2½ years.

Case 68.—H., age 29; female. (1907.) Site of tumor, radius. Character of injury, severe blow. Interval between injury and appearance of tumor, 5 months. Giant-celled.

Case 69.—H., age 15; male. (1908.) Site of tumor, femur. Character of injury, fall, injuring upper part of femur. Interval between injury and appearance of tumor, 3 months. Periosteal upper third.

Case 70.—H., age 46; male. (1908.) Site of tumor, humerus. Character of injury, fall. Interval between injury and appearance of tumor, 4 weeks.

Case 71.—J., age 8; male. (1901.) Site of tumor, back. Character of injury, severe bruise from fall. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 72.—J., age 59; female. (1909.) Site of tumor, heel. Character of injury, trauma from nail in shoe. Interval between injury and appearance of tumor, soon. Tumor; stationary several years.

Case 73.—J., age 31; male. (1908.) Site of tumor, neck. Character of injury, muscular strain. Interval between injury and appearance of tumor, 4 weeks.

Case 74.—K., age 49; male. (1889.) Site of tumor, neck. Character of injury, blow from block of wood. Interval between injury and appearance of tumor, 4 months.

Case 75.—K., age 23; male. (1900.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, 1 year.

Case 76.—K., age 51; male. (1898.) Site of tumor, clavicle. Character of injury, carried heavy bar of steel on shoulder one-quarter mile. Interval between injury and appearance of tumor, 1 month later tumor exact site.

Case 77.—K., age 1; female. (1894.) Site of tumor, metatarsal bone. Character of injury, fall. Interval between injury and appearance of tumor, few weeks.

Case 78.—L., age 18; female. (1898.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, 2 months.

Case 79.—L., age 40; female. (1899.) Site of tumor, face. Character of injury, blow from fist. Interval between injury and appearance of tumor, few days.

Case 80.—L., age 35; female. (1906.) Site of tumor, pubic bone. Character of injury, injury by forceps delivery; severe labor. Interval between injury and appearance of tumor, 2 months.

Case 81.—L., age 35; male. (1905.) Site of tumor, inguinal region. Character of injury, slipped, with severe strain of muscles in groin. Interval between injury and appearance of tumor, few weeks.

Case 82.—L., age 44; female. (1906.) Site of tumor, thigh. Character of injury, strain. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 83.—L., age 13, male. (1906.) Site of tumor, supraclavicular glands. Character of injury, strain. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 84.—L. age 31; male. (1904.) Site of tumor, testis. Character of injury, severe kick. Interval between injury and appearance of tumor, soon after; few days.

Case 85.—L., age 33; male. (1908.) Site of tumor, mole on ankle. Character of injury, cauterized. Interval between injury and appearance of tumor, at once. Melanotic.

Case 86.—L., age 43; female. (1906.) Site of tumor, gluteal region. Character of injury, knocked down by bicycle, striking on buttock. Interval between injury and appearance of tumor, 1 year.

Case 87.—L., age 11 months; male. (1907.) Site of tumor, tibia. Character of injury, strain. Interval between injury and appearance of tumor, 2 days.

Case 88.—O., age 62; male. (1898.) Site of tumor, clavicle. Character of injury, severe blow by beam. Interval between injury and appearance of tumor, 9 years, exact spot.

Case 89.—O., age 13; male. (1909.) Site of tumor, back. Character of injury, fell from hammock to hard floor. Interval between injury and appearance of tumor, 1½ years.

Case 90.—P., age 29; male. (1908.) Site of tumor, ilium. Character of injury, thrown from horse, dragged 21 feet. Interval between injury and appearance of tumor, 8 years.

Case 91.—P., age 32; female. (1908.) Site of tumor, buttock. Character of injury, fell through broken floor; severe bruise. Interval between injury and appearance of tumor, few days. Round-celled.

Case 92.—P., age 45; male. (1902.) Site of tumor, pectoral region. Character of injury, severe muscular strain. Interval between injury and appearance of tumor, 6 months.

Case 93.—S., age 42; female. (1906.) Site of tumor, toe. Character of injury, heavy iron fell on toe; 4 years later second injury, heavy iron on same toe. Interval between injury and appearance of tumor, first injury 4 years developed soon; few weeks after second injury.

Case 94.—L., age 45; male. (1906.) Site of tumor, parotid. Character of injury, severe blow; fell on log. Interval between injury and appearance of tumor, 3 years.

Case 95.—M., age 10; female. (1907.) Site of tumor, tibia. Character of injury, blow. Interval between injury and appearance of tumor, 4 months.

Case 96.—L., age 59; female. Site of tumor, femur. Character of injury, fall from street car. Interval between injury and appearance of tumor, 6 months.

Case 97.—L., age 21; male. (1906.) Site of tumor, ribs. Character of injury, fall; fractured ribs. Interval between injury and appearance of tumor, few weeks.

Case 98.—M., age 37; male. (1900.) Site of tumor, thigh. Character of injury, blow against heavy lounge. Interval between injury and appearance of tumor, 2 weeks.

Case 99.—M., age 55; male. (1903.) Site of tumor, humerus. Character of injury, blow. Interval between injury and appearance of tumor, few days.

Case 100.—M., age 10; male. (1908.) Site of tumor, ilium. Character of injury, ran against telephone pole; bruise of thigh. Interval between injury and appearance of tumor, 2 weeks.

Case 101.—M., age 41; female. (1900.) Site of tumor, breast. Character of injury, fall from bicycle, bruising breast. Interval between injury and appearance of tumor, 1 year.

Case 102.—B., age 52; male. (1908.) Site of tumor, ilium. Character of injury, fall. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 103.—M., age 27; male. (1898.) Site of tumor, testis. Character of injury, blow. Interval between injury and appearance of tumor, small tumor appeared almost at once; remained dormant 6 years, then began to grow. Round-celled.

Case 104.—M., age 28; male. (1899.) Site of tumor, testis. Character of injury, fall from bicycle. Interval between injury and appearance of tumor, 1 year.

Case 105.—M., age 22; male. (1898.) Site of tumor, ischium. Character of injury, fall on ice, striking tuberosity of ischium. Interval between injury and appearance of tumor, few days later.

Case 106.—M., age 37; female. (1898.) Site of tumor, inferior maxilla. Character of injury, severe blow. Interval between injury and appearance of tumor, 2 to 3 months.

Case 107.—M., age 55; male. (1898.) Site of tumor, parotid. Character of injury, severe blow from horse's head. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 108.—M., age 8; male. (1902.) Site of tumor, superior maxilla. Character of injury, fell from bicycle, driving eye-tooth into upper jaw. Interval between injury and appearance of tumor, 1½ years.

Case 109.—M., age 46; male. (1905.) Site of tumor, ischium. Character of injury, fall. Interval between injury and appearance of tumor, 2 years.

Case 110.—N., age 38; male. (1907.) Site of tumor, ischium. Character of injury, fall on sidewalk, striking tuberosity of ischium. Interval between injury and appearance of tumor, 2 months.

Case 111.—S., age 25; male. (1906.) Site of tumor, ulna. Character of injury, green stick fracture. Interval between injury and appearance of tumor, 2 to 3 months; began in callus.

Case 112.—W., age 46; female. (1909.) Site of tumor, supra-clavicular glands. Character of injury, blow from falling window. Interval between injury and appearance of tumor, 1 week.

Case 113.—W., age 60; male. (1899.) Site of tumor, inferior maxilla. Character of injury, piece of jaw broken off in extracting tooth. Interval between injury and appearance of tumor, few weeks.

Case 114.—H., age 35; male. (1906.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, few months (2 to 3).

Case 115.—W., age 20; female. (1900.) Site of tumor, tibia. Character of injury, fall. Interval between injury and appearance of tumor, 1½ years. Round-celled.

Case 116.—W., age 15; female. (1907.) Site of tumor, humerus. Character of injury, blow. Interval between injury and appearance of tumor, 10 years. Round-celled.

Case 117.—C., age 37; male. (1898.) Site of tumor, groin. Character of injury, blow; ran against corner of table. Interval between injury and appearance of tumor, few days.

Case 118.—C., age 25; female. (1899.) Site of tumor, parotid. Character of injury, blow from baseball. Interval between injury and appearance of tumor, 2 years.

Case 119.—C., age 36; female. (1898.) Site of tumor, scalp. Character of injury, heavy blow from falling window. Interval between injury and appearance of tumor, few days.

Case 120.—V., age 16; male. (1909.) Site of tumor, clavicle. Character of injury, severe muscular strain. Interval between injury and appearance of tumor, 3 weeks.

Case 121.—L., age 32; male. (1910.) Site of tumor, humerus. Character of injury, fracture. Interval between injury and appearance of tumor, 5 to 6 weeks.

Case 122.—F., age 46; female. (1910.) Site of tumor, tibia. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 123.—H., age 63; male. (1910.) Site of tumor, back. Character of injury, fall. Interval between injury and appearance of tumor, 4 years.

Case 124.—G., age 31; male. (1910.) Site of tumor, calf of leg. Character of injury, trauma to pigmented mole. Interval between injury and appearance of tumor, at once. Melanotic.

Case 125.—M., age 42; male. (1904.) Site of tumor, testis. Character of injury, contusion. Interval between injury and appearance of tumor, 2 to 3 months.

Case 126.—F., age 38; male. (1906.) Site of tumor, clavicle. Character of injury, severe muscular strain. Interval between injury and appearance of tumor, 1 week.

Case 127.—O., age 11; male. Site of tumor, rectus muscle. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 128.—G., age 14; male. (1910.) Site of tumor, tibia. Char-

acter of injury, sprain of leg. Interval between injury and appearance of tumor, few days; later pain and swelling.

Case 129.—W., age 19; male. (1897.) Site of tumor, thigh. Character of injury, pigmented mole ligated with silk. Interval between injury and appearance of tumor, few days. Melanotic.

Case 130.—D., age 33; male. (1899.) Site of tumor, thigh. Character of injury, bad fall; rendered unconscious. Interval between injury and appearance of tumor, 6 months.

Case 131.—G., age 21; male. (1902.) Site of tumor, back. Character of injury, wrenched back wrestling. Interval between injury and appearance of tumor, few weeks.

Case 132.—H., age 24; male. (1899.) Site of tumor, superior maxilla. Character of injury, piece of jaw broken off extracting tooth. Interval between injury and appearance of tumor, 2 months.

Case 133.—H., age 18; male. (1899.) Site of tumor, humerus. Character of injury, fell 3 stories, injuring shoulder. Interval between injury and appearance of tumor, 2 months.

Case 134.—L., age 44; female. (1903.) Site of tumor, inferior maxilla. Character of injury, jaw injured in extracting tooth. Interval between injury and appearance of tumor, 2 months.

Case 135.—M., age 58; male. (1899.) Site of tumor, humerus. Character of injury, injured shoulder against trolley car. Interval between injury and appearance of tumor, 1 month.

Case 136.—M., age 29; male. (1910.) Site of tumor, sacro-iliac. Character of injury, sprain. Interval between injury and appearance of tumor, few weeks.

Case 137.—M., age 37; female. (1902.) Site of tumor, foot. Character of injury, trauma to pigmented mole. Interval between injury and appearance of tumor, few weeks. Melanotic.

Case 138.—N., age 2 months; male. (1910.) Site of tumor, scapula. Character of injury, difficult birth; left shoulder strained. Interval between injury and appearance of tumor, 2 weeks.

Case 139.—R., age 35; male. (1905.) Site of tumor, undescended testis. Character of injury, trauma, from application of truss. Interval between injury and appearance of tumor, few weeks; pain and swelling. Round-celled.

Case 140.—R., age 34; female. (1910.) Site of tumor, fibula. Character of injury, kicked by horse, 1897. Interval between injury and appearance of tumor, tumor (bony) few weeks later at site of injury. Quiescence 5 years, then rapidly growing spindle-celled sarcoma.

Case 141.—R., age 46; male. (1907.) Site of tumor, orbit. Character of injury, blow. Interval between injury and appearance of tumor, few days.

Case 142.—T., age 52; male. (1903.) Site of tumor, pectoral region. Character of injury, trauma of pigmented mole. Interval between injury and appearance of tumor, at once. Melanotic.

Case 143.—L., age 24; female. (1899.) Site of tumor, thigh. Character of injury, repeated trauma, sitting on hard chair at sewing machine.

Interval between injury and appearance of tumor, tumor developed just where edge of chair touched thigh. Round-celled.

Case 144.—S., age 5½; male. (1899.) Site of tumor, groin. Character of injury, fall. Interval between injury and appearance of tumor, few days.

Case 145.—W., age 55; male. (1901.) Site of tumor, thigh. Character of injury, trauma to pigmented mole. Interval between injury and appearance of tumor, few days.

Case 146.—H., age 34; male. (1908.) Site of tumor, clavicle. Character of injury, heavy plank fell on shoulder. Interval between injury and appearance of tumor, 6 years.

Case 147.—A., age 32; female. (1909.) Site of tumor, thigh. Character of injury, trauma of pigmented mole (electrocautery). Interval between injury and appearance of tumor, at once.

Case 148.—B., age 49; male. (1900.) Site of tumor, femur. Character of injury, fracture from kick of horse. Interval between injury and appearance of tumor, 2 to 3 months.

Case 149.—W., age 50; male. (1910.) Site of tumor, thigh. Character of injury, blow. Interval between injury and appearance of tumor, few weeks. Spindle-celled.

Case 150.—J., age 19; female. (1910.) Site of tumor, hand. Character of injury, sprain. Interval between injury and appearance of tumor, few weeks.

Case 151.—H., age 58; female. (1901.) Site of tumor, breast (skin). Character of injury, fall. Interval between injury and appearance of tumor, 2 years. Melanotic.

Case 152.—G., age 32; male. (1901.) Site of tumor, abdominal wall. Character of injury, fell down stairs. Interval between injury and appearance of tumor, 2 to 3 months.

Case 153.—K., age 37; male. (1906.) Site of tumor, shoulder (humerus). Character of injury, strain. Interval between injury and appearance of tumor, 1 month.

Case 154.—M., age 46; male. (1903.) Site of tumor, clavicle. Character of injury, dislocation of shoulder. Interval between injury and appearance of tumor, 2 to 3 months later. Round-celled.

Case 155.—H., age 40; male. (1908.) Site of tumor, clavicle. Character of injury, severe contusion from falling bar of steel. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 156.—W., age 37; male. (1900.) Site of tumor, thigh. Character of injury, fall. Interval between injury and appearance of tumor, few weeks.

Case 157.—K., age 10; male. (1911.) Site of tumor, groin. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 158.—K., age 16; female. (1904.) Site of tumor, ilium. Character of injury, fall. Interval between injury and appearance of tumor, few months.

Case 159.—P., age 35; female. (1910.) Site of tumor, ilium. Character of injury, fall. Interval between injury and appearance of tumor, 6 months.

Case 160.—F., age 52; female. (1898.) Site of tumor, fibula. Character of injury, fall. Interval between injury and appearance of tumor, 2 months.

Case 161.—T., age 35; female. (1898.) Site of tumor, thigh. Character of injury, fall. Interval between injury and appearance of tumor, few days.

Case 162.—M., age 41; female. (1900.) Site of tumor, breast. Character of injury, fall; contusion of breast. Interval between injury and appearance of tumor, 1 year.

Case 163.—Q., age 60; female. (1899.) Site of tumor, leg. Character of injury, ligature of pigmented mole. Interval between injury and appearance of tumor, at once.

Case 164.—K., age 18; male. (1909.) Site of tumor, foot. Character of injury, tearing ligament; forcible correction of flat-foot. Interval between injury and appearance of tumor, 2 weeks.

Case 165.—H., age 10; male. (1910.) Site of tumor, inguinal canal. Character of injury, scar of hernia operation. Interval between injury and appearance of tumor, 5 weeks after operation. Very malignant.

Case 166.—S., age 6; male. (1897.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, few weeks.

Case 167.—S., age 40; male. (1906.) Site of tumor, femur. Character of injury, fall. Interval between injury and appearance of tumor, few months.

Case 168.—U., age 45; male. (1905.) Site of tumor, thigh. Character of injury, blow. Interval between injury and appearance of tumor, few months.

Case 169.—T., age 58; female. (1905.) Site of tumor, forehead. Character of injury, blow. Interval between injury and appearance of tumor, 1 month.

Case 170.—M., age 52; female. (1906.) Site of tumor, breast. Character of injury, blow. Interval between injury and appearance of tumor, 2 weeks.

Case 171.—D., age 15; male. (1906.) Site of tumor, sacrum. Character of injury, sprain. Interval between injury and appearance of tumor, few weeks.

Case 172.—V., age 33; male. (1906.) Site of tumor, tibia. Character of injury, fall; twist of knee. Interval between injury and appearance of tumor, 10 months.

Case 173.—B.; female. (1910.) Site of tumor, shoulder. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 174.—B., age 16; male. (1910.) Site of tumor, coccyx. Character of injury, kick. Interval between injury and appearance of tumor, 1 week.

Case 175.—C., age 40; male. (1908.) Site of tumor, toe. Character of injury, run over by auto. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 176.—M., age 19; female. (1904.) Site of tumor, femur.

Character of injury, fracture. Interval between injury and appearance of tumor, few weeks.

Case 177.—M., age 8; male. (1906.) Site of tumor, clavicle. Character of injury, fall from wire fence. Interval between injury and appearance of tumor, 3 to 4 weeks.

Case 178.—S., age 5; male. (1911.) Site of tumor, back; extraspinal. Character of injury, fall. Interval between injury and appearance of tumor, few weeks.

Case 179.—S., age 14; male. (1910.) Site of tumor, sacrolumbar spine. Character of injury, fall on ice; severe blow in sacral region. Interval between injury and appearance of tumor, pain severe 2 months later; swelling 6 months later.

From the foregoing tables, comprising 225 cases (46 old and 179 new), it will be seen that 105 or 46.66 per cent. of the cases originated in the bone; 120 or 53.33 per cent. in the soft parts.

They were distributed as follows:

BONES.

Femur	21	Spine	2
Fibula and tibia.....	15	Pubic bone	1
Humerus	7	Ribs	3
Ulna	3	Mastoid	1
Radius	2	Skull	1
Metatarsal bone	2	Orbit	3
Clavicle	10	Forehead	2
Scapula	4	Superior maxilla	5
Ilium	15	Inferior maxilla	3
Ischium	3		
Sacrum	1	Total	105
Coccyx	1		

SOFT PARTS.

Thigh	19	Back	5
Leg	5	Chest	1
Inguinal region	4	Supraclavicular glands	2
Ankle	1	Scapular region	1
Foot	7	Neck	4
Toe	3	Tonsil	1
Heel	3	Parotid	8
Forearm	4	Face	3
Hand	3	Scalp	2
Thumb	1	Cheek	1
Abdomen	3	Ear	1
Rectus muscle	1	Testis	13
Kidney	2	Scrotum	1
Gluteal region	5	Ovary	2
Breast, pectoral region, and axilla	14	Total	120

The interval elapsing between the injury and the appearance of the tumor was as follows:

Less than 1 week.....	50	6 to 12 months.....	15
1 to 2 weeks.....	13	1 to 2 years.....	17
2 weeks to a month.....	54	2 to 3 years.....	5
1 to 2 months.....	23	Over 3 years.....	17
2 to 6 months.....	31		

117 cases within one month after injury.

TABLE III.

CASES OF CARCINOMA OF BREAST ASSOCIATED WITH ANTECEDENT TRAUMA.

Case 1.—B., age 43; female. (1909.) Site of tumor, breast, double. Character of injury, caught on door of elevated train; severe bruises both breasts. Interval between injury and appearance of tumor, 6 years later; tumor began in both breasts 3 weeks apart.

Case 2.—B., age 59; female. (1910.) Site of tumor, right breast. Character of injury, fall, striking breast on back of chair. Interval between injury and appearance of tumor, 2 weeks.

Case 3.—D., age 30; female. (1906.) Site of tumor, both breasts. Character of injury, pressure of aluminum corset.

Case 4.—E., age 56; female. (1907.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 5.—M., age 55; female. (1895.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 6.—G., age 68; female. (1910.) Site of tumor, left breast. Character of injury, kicked by 2-year-old child. Interval between injury and appearance of tumor, 6 months.

Case 7.—T., age 60; female. (1910.) Site of tumor, right breast. Character of injury, fall, injuring breast. Interval between injury and appearance of tumor, few weeks. Death in 2 years.

Case 8.—P., age 70; female. (1906.) Site of tumor, right breast. Character of injury, blow against iron faucet. Interval between injury and appearance of tumor, 1 month.

Case 9.—S., age 64; female. (1905.) Site of tumor, right breast. Character of injury, blow; struck against fence, bruising breast. Interval between injury and appearance of tumor, soon (few days).

Case 10.—C., age 33; female. (1895.) Site of tumor, right breast. Character of injury, blow; black and blue area. Interval between injury and appearance of tumor, effects of bruise disappeared 2 to 3 weeks later; lump.

Case 11.—D., age 33; female. (1902.) Site of tumor, double, breast. Character of injury, knocked down, striking both breasts on asphalt pavement. Interval between injury and appearance of tumor, right, 2 to 3 weeks; left, 6 months.

Case 12.—D., age 59; female. (1908.) Site of tumor, left breast.

Character of injury, blow; struck breast against heavy piece of furniture. Interval between injury and appearance of tumor, 2 months.

Case 13.—G., age 48; female. (1902.) Site of tumor, left breast. Character of injury, fall. Interval between injury and appearance of tumor, 2 to 3 months.

Case 14.—H., age 64; male. (1903.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, 6 months.

Case 15.—L., age 45; female. (1903.) Site of tumor, left breast. Character of injury, blow. Interval between injury and appearance of tumor, 2 years.

Case 16.—S., age 60; female. (1903.) Site of tumor, left breast. Character of injury, severe blow by elbow of a hospital patient. Interval between injury and appearance of tumor, 2 months.

Case 17.—M., age 46; female. (1903.) Site of tumor, right breast. Character of injury, fell flat upon pavement, injuring right breast. Interval between injury and appearance of tumor, 6 months.

Case 18.—M., age 37; female. (1901.) Site of tumor, left breast. Character of injury, blow; struck by baseball (batted ball). Interval between injury and appearance of tumor, 3 to 4 days, exact site of injury.

Case 19.—M., age 46; female. (1904.) Site of tumor, left breast. Character of injury, blow from baseball (thrown ball). Interval between injury and appearance of tumor, 5 months.

Case 20.—B., age 39; female. (1907.) Site of tumor, right breast. Character of injury, ran against sharp corner of table; severe blow. Interval between injury and appearance of tumor, few days.

Case 21.—R., age 27; female. (1910.) Site of tumor, right breast. Character of injury, fell, striking right breast upon wooden chest. Interval between injury and appearance of tumor, 3 years.

Case 22.—B., age 45; female. (1904.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 23.—A., age 62; female. (1895.) Site of tumor left breast. Character of injury, fall, striking on right breast. Interval between injury and appearance of tumor, 1 year.

Case 24.—B., age 45; female. (1897.) Site of tumor, right breast. Character of injury, blow; ran against banister. Interval between injury and appearance of tumor, 1 year

Case 25.—B., age 38; female. (1896.) Site of tumor, right breast. Character of injury, fall. Interval between injury and appearance of tumor, few weeks.

Case 26.—B., age 49; female. (1900.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, 3 years.

Case 27.—C., age 43; female. (1895.) Site of tumor, right breast. Character of injury, severe blow from tennis ball; caused fainting. Interval between injury and appearance of tumor, 1 year.

Case 28.—C., age 59; female. (1905.) Site of tumor, left breast. Character of injury, severe strain to pectoral muscle. Interval between injury and appearance of tumor, 2 years.

Case 29.—C., age 54; female. (1908.) Site of tumor, right breast. Character of injury, severe blow. Interval between injury and appearance of tumor, few months.

Case 30.—C., age 43; female. (1908.) Site of tumor, left breast. Character of injury, severe blow. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 31.—C., age 57; female. (1905.) Site of tumor, right breast. Character of injury, severe blow; struck against bedstead. Interval between injury and appearance of tumor, 2 months.

Case 32.—B., age 35; male. (1900.) Site of tumor, right breast. Character of injury, struck with baseball.

Case 33.—M., age 39; female. (1905.) Site of tumor, left breast. Character of injury, trauma from wearing bag of jewels under corset against breast. Interval between injury and appearance of tumor, 3 to 4 months.

Case 34.—M., age 50; female. (1906.) Site of tumor, right breast. Character of injury, fall; striking on right breast on table. Interval between injury and appearance of tumor, 3 to 4 weeks.

Case 35.—M., age 50; female. (1907.) Site of tumor, right breast. Character of injury, fall, striking right breast on corner of bedstead. Interval between injury and appearance of tumor, few weeks.

Case 36.—P., age 55; female. (1903.) Site of tumor, left breast. Character of injury, struck left breast against trolley car. Interval between injury and appearance of tumor, pain 1 month; tumor 2 months.

Case 37.—R., age 37; female. (1898.) Site of tumor, left breast. Character of injury, fall, striking breast against bedstead. Interval between injury and appearance of tumor, 3 to 4 weeks.

Case 38.—R., age 39; female. (1902.) Site of tumor, right breast. Character of injury, severe blow, striking breast against large nail in wall. Interval between injury and appearance of tumor, 1 year.

Case 39.—S., age 63; female. (1896.) Site of tumor, right breast. Character of injury, bruise in carrying heavy wooden pole under arm. Interval between injury and appearance of tumor, 6 months.

Case 40.—S., age 40; female. (1896.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, 1½ years.

Case 41.—S., age 30; female. (1895.) Site of tumor, left breast. Character of injury, severe blow against bedstead. Interval between injury and appearance of tumor, 14 years.

Case 42.—S., age 39; female. (1899.) Site of tumor, right breast. Character of injury, blow; ran against heavy wooden object. Interval between injury and appearance of tumor, 6 months.

Case 43.—S., age 48; female. (1901.) Site of tumor, left breast. Character of injury, severe blow from bicycle. Interval between injury and appearance of tumor, 4 years; exact site.

Case 44.—S., age 36; female. (1906.) Site of tumor, right breast. Character of injury, severe blow; ran against table. Interval between injury and appearance of tumor, 5 months.

Case 45.—S., age 70; female. (1906.) Site of tumor, right breast.

Character of injury, blow; severe bruise by striking breast against bedstead iron. Interval between injury and appearance of tumor, black and blue area at once; tumor developed few days later.

Case 46.—T., age 42; female. (1895.) Site of tumor, left breast. Character of injury, blow. Interval between injury and appearance of tumor, few weeks.

Case 47.—W., age 55; female. (1910.) Site of tumor, left breast. Character of injury, blow; struck breast against door knob. Interval between injury and appearance of tumor, 3 to 4 weeks.

Case 48.—W., age 40; female. (1907.) Site of tumor, right breast. Character of injury, fall, striking right breast against corner of wooden box. Interval between injury and appearance of tumor, severe swelling; next day all disappeared; tumor noticed exact site few weeks later.

Case 49.—W., age 30; female. (1905.) Site of tumor, left breast. Character of injury, kicked in left breast by 2-year-old child; caused black and blue area. Interval between injury and appearance of tumor, 1 month later exact site of injury.

Case 50.—C., age 37; female. (1910.) Site of tumor, right breast. Character of injury, blow. Interval between injury and appearance of tumor, 2 to 3 weeks.

Case 51.—S., age 54; female. (1907.) Site of tumor, left breast. Character of injury, blow; ran against sideboard; injuring left breast. Interval between injury and appearance of tumor, 9 months.

Case 52.—C., age 54; female. (1901.) Site of tumor, right breast. Character of injury, kicked by child. Interval between injury and appearance of tumor, 2 years.

The interval elapsing between the injury and the appearance of the breast tumor was as follows:

Less than 1 week.....	5	6 to 12 months.....	7
2 weeks to a month.....	14	1 to 2 years.....	5
1 to 2 months.....	3	2 to 3 years.....	3
2 to 6 months.....	8	Over 3 years.....	7

The closest connection between the effect of injury upon sarcoma and carcinoma is found in the group of tumors classed as melanotic sarcomas. Nineteen of such cases are included in my series in which the development of the tumor followed some definite injury, such as the tying off of a pigmented mole, or bruising it sufficiently to make it bleed, or burning it with a cautery.

Now this group of tumors is classed by some pathologists as sarcoma, by others, and an increasing number at the present time, as carcinoma. Certainly, in many features, like the involvement of the nearest glands, they closely resemble the carcinomatous group.

While I have not had so large an opportunity to study the relationship between trauma and carcinoma, I have made an analysis of a series of 250 cases of carcinoma which have come under my personal observation, and in which the histories were taken by myself. In this series of cases there was a history of antecedent trauma in 82, 32.8 per cent.; 120 cases were carcinoma of the breast, in 52 or 43.33 per cent., of which there was a history of a single antecedent trauma. This may seem like a very large percentage, but it is smaller than was observed at the Presbyterian Hospital by McWilliams.

Clarence A. McWilliams in the Medical and Surgical Report of the Presbyterian Hospital, on "Statistics of 100 Cases of Cancer of the Breast" (*Med. News*, April 28, 1900) observed at said hospital, states with reference to trauma as a causative factor: "In our list there is a record on this point in 65 of the patients, of which number 29, or 44.6 per cent. gave the history of a distinct antecedent trauma."

To fully explain the nature of this relationship is quite another problem than to prove that it actually exists.

Von Bergmann has no doubt that a single contusion of the muscles or glands may be the predisposing cause for all types of cancer, and his explanation that the injury produces an extravasation of blood which remains as a focus, which, later, forms a favorable nidus for the development of a cancer, is perhaps as reasonable as any that has been offered.

In my earlier paper on "The Influence of Injury upon the Development of Sarcoma" (*ANNALS OF SURGERY*, March, 1898), I offered as a possible explanation of the causative relationship of trauma to sarcoma, that: "We have only to follow out the analogy between sarcoma and tuberculosis. If we can explain how it is that tuberculous inflammations of the bones develop after an injury in children previously apparently in good health, then the same explanation could be applied to sarcoma. That such cases are by no means uncommon, has been proven by Gude, Tillman, and other surgeons. The probable explanation in these cases is that the tubercle bacilli exist latent in many individuals, and may remain harmless indefinitely under normal conditions. The trauma lowers the vitality

and, hence, the resisting power of the part injured, and the bacilli previously innocuous gain a foothold and develop. We know that we can get a suppurative periostitis from traumatism without any breaking of the continuity of the skin, and we must explain this in the same way. It is not difficult to believe that the infectious cause of sarcoma is one widely distributed and generally innocuous until some cause, *e.g.*, a trauma, places the tissues in such a condition as to furnish the proper soil for its development."

Dr. John B. Murphy in his recent paper on "The Surgery of the Joints," read before the New York Academy of Medicine (*Medical Record*, Feb. 11, 1911), states: "Virulent pneumococci were injected in dogs with a very fine needle and without producing any trauma or displacement of the endothelial cells; there resulted no response to the infection; when traumatization of the endothelium took place, however, there was a decided response."

The question of the relationship between injury and cancer has received a good deal of attention during the last three years in Europe, especially from a medicolegal point of view. One of the most important papers that has ever been written upon the subject was that of Paul Segond, Professor of Clinical Surgery of the Faculty of Medicine, France, presented before the Congress of French Surgeons in October, 1907, and discussed at great length. Segond attempted not only to determine whether or not there was a causal relationship between injury and the development of malignant tumors from the medical point of view, but he went further and discussed the problem from the medicolegal stand-point.

He said that in France, the same as in Germany and Belgium, the law is based exclusively upon a principle of indemnification which holds that every injury sustained in the course of work is subject to an indemnity, fixed in advance and varying according to the diminished capacity of the injured person for performing his work, but absolutely independent of any diseases or infirmities he might have had prior to the accident. From a legal stand-point the three following conditions must obtain:

1. It is necessary to prove that an accident occurred.
2. That there was a relation of cause and effect between the accident and the neoplasm.

3. That the accident was connected with the work in hand.

The law does not apply to professional maladies, that is, no indemnity is granted in cases in which the tumor is supposed to have been the result of *repeated slight injuries* or *prolonged irritations* connected with the particular occupation of the claimant. In other words, it must be an accident, that is to say, a "bodily lesion resulting from the action of an external and sudden cause, occurring in the course of labor." The law takes no account of anterior states or predispositions. In France, Second states, the law concerning the accidents of labor promulgated in 1898, claims for indemnity for tumors were exceedingly few up to that time; practically all failed to receive any indemnity owing to the declaration on the part of the deponents that the tumor existed prior to the accident. He cites what he calls a very remarkable case, published by Gerné, Didier, and Jeanne of Rouen (*La Normandie Medicale*, Dec. 15, 1906), in which the causal relationship between accident and cancer was sustained by the court. This case is worth recording in brief:

Man, thirty-two years of age, in September, 1904, fell upon a rail and received localized contusions of his left knee. He remained in bed eight days and then resumed his work. Seven months later, the following February, he was obliged to stop work on account of the pain in the knee. He noticed an enlargement at about this time, which continued to increase in size. Amputation was performed by Jeanne in September, 1905, for osteosarcoma of the tibia. In October, Drs. Gerné, Didier and Jeanne were commissioned by the court of Rouen to examine the patient and to state whether the amputation became necessary as a consequence of the accident of September 20, 1904. Their conclusion was: "In the present case, it is impossible to break the chain of facts—contusion at the precise point at which later was found the maximum development of a sarcoma. A period of some months during which there seemed to be practically no result from the contusion (this latent period proves that the assumption of the pre-existence of a tumor at this point was not admissible). After this delay, pain and the progressive development of a tumor, eleven months after the accident, sufficiently developed to be recognized externally. We consider truly that one can only regard this as an example in which a sarcoma was caused by a contusion." The court accepted the opinion expressed by the experts and condemned the inter-

ested company to pay him a pension representing the incapacity resulting from the amputation.

Second states that in Germany four conditions obtain for internal cancer of supposed traumatic origin:

1. That the accident has been of a nature to provoke an internal lesion, such as a laceration or contusion of the mucous surface of the stomach or intestine, which may favor the later development of a cancer.

2. That the victim has had the appearance of perfect health before the accident.

3. That since the accident up to the time of death, the victim has had symptoms of disease proving the steady progression of the inflammation of the mucous membrane, gradually transforming the condition into cancerous disease.

4. That the autopsy has revealed the presence of a cancer in the region of the traumatism.

These conditions show how much more strongly and broadly the theory that injury may be the cause of a malignant tumor has been accepted in Germany than in France.

Second cites three cases in which the courts allowed an indemnity for intra-abdominal cancer, on the ground that it was presumably the result of an injury. One was a cancer of the stomach, following a severe contusion of the thoracic region; the second, a cancer of the stomach, resulting from a fall prone upon a boat; the tumor developed five years later; the third had a severe fall and injured the right side of the abdomen. Severe pains immediately followed (May, 1899). On June 19, the same year, a laparotomy was done and a perforated appendix and a purulent peritoneal abscess found. Three and a half years later the man died of cancer of the colon, as proved by autopsy.

Professor Thiem, who has made a careful study of the question of the influence of injury upon tumor development, was called as an expert in this case. He believed that the state of chronic inflammation, which had persisted at the site of the cæcum and the neighboring organs after operation, favored the development of a cancer, and concluded as follows: "In this sense, a relation of cause and effect between accident and the

cancerous tumor can be conceived." Conforming to this conclusion, the Imperial Office admitted the existence of a causal relationship between the accident and the death of the victim.

Segond cites other cases, which, however, I will not quote.

Assisted by Jeanbrean, Segond made a study of 61 papers, and reports on the subject of the relationship between accident and cancer. These bibliographic researches show 600 observations, 356 of which were considered by their authors as having an undoubted clinical value. He, however, believes that none of these observations is absolutely conclusive, and almost all are incomplete. They fail in part in the fundamental point, in not telling about the condition of the region injured prior to the accident, and the greater part of them are lacking in details as to the degree of the traumatic violence, the exact date of the appearance of the tumor, and its histological examination. If one were attempting a strictly scientific demonstration to which no objection could be made, on basis of these cases, one could not find in these 356 observations a single one in which the traumatic origin was beyond dispute, as in no case was there a medical examination of the parts prior to the accident, which would preclude the chronic existence of the tumor before the accident. Segond further addressed personal communications to 600 French and foreign surgeons, getting, however, only 23 replies, and states that six of these had not formed an opinion; four pronounced themselves very skeptical, while 14 expressed a more or less positive belief in the causal relationship between accident and cancer, and based the same upon series of cases which were briefly recorded.

The criticism that I made of Phelps's study of the question holds true largely in the case of Segond's more elaborate paper. They both attempt to settle the question by a study of a large number of statistics of other men, rather than by the presentation of new and original facts. They both assume—before accepting the fact of the causal relationship between injury and tumor development—that it is necessary to offer a perfect explanation of such relationship. The question of the causal relationship between trauma and cancer should be determined by a careful scientific and judicial study of all the

facts bearing on such relationship. That is a question entirely independent of our ability or inability to offer a satisfactory explanation as to the nature of such relationship.

Both Phelps and Second make too great an effort to discredit the direct statements of intelligent patients. When a woman of more than ordinary intelligence strikes her breast against a sharp corner of a bureau, causing the characteristic signs of a local contusion (ecchymosis and tenderness), when a careful examination of the place immediately after the injury fails to reveal the presence of any tumor, but one or two or three weeks, or a month later, a hard tumor develops at exactly the point of injury, the supposed causal relationship may, with Phelps, be attributed to the "unreliability of patients' logical processes which have hypnotized the attending physician into accepting the improbable assertions as undoubted facts." But, when in the case of a fractured humerus in a man in perfect health, we have an X-ray photograph taken immediately after the fracture, as in my case, showing absolutely normal bone structure, and a few weeks later, another photograph shows a typical sarcomatous tumor, developing at the exact site of the fracture, and when subsequent operation with microscopical examination proves the correctness of the diagnosis; and again, when a surgeon makes an incision in the inguinal region for the operation for inguinal hernia, through absolutely normal structures, and four weeks later there develops at the exact site of the incision, involving all the layers of the scar, a rapidly growing round-celled sarcoma, we have facts which in no way depend upon the logical or illogical processes of patients, and which demand a more rational explanation.

Here we have a medical examination by competent surgeons immediately before the trauma or tumor development, and in a few weeks thereafter,—not an indefinite number of years, but a few weeks afterward,—we have the development of a highly malignant tumor at the exact site of the injury, and the histological structure of this tumor in every case demonstrated by microscopical examination made by competent pathologists.

My series of cases contains a large number of others

almost equally conclusive. If, then, we have even a few cases that fulfil every condition proposed by Segond and others, and which must be admitted as proving a direct causal relationship, it is perfectly logical to believe that in most other cases in which circumstances did not permit of the fulfilment of all of these conditions, especially the medical examination directly prior to the injury, the trauma played the same rôle in the tumor development.

The majority of those who admit an injury as a direct or inciting cause assume the presence of a hereditary influence or some other predisposing cause. Our knowledge of heredity is at present extremely vague, and the courts in France and Germany have refused to consider it in such cases. I will only say that in my own cases the proportion of patients with a history of cancer in some member of the family (heredity) was much smaller in the traumatic cases than in the cases in which there was no antecedent trauma.

Personally I believe (and more strongly with increasing experience) that all types of malignant tumors are of extrinsic origin. It is not improbable that what we have hitherto included under the vague term of hereditary influence may some day be proven contagion or virus, as has already been done in tuberculosis.

Whether we accept the parasitic theory of cancer, or still believe in its intrinsic origin, we must admit that trauma plays a direct and important part in the development of cancer. The argument advanced by some writers, that if such were true, all cases of trauma or a larger proportion of cases ought to be followed by cancer, is not logical. If 50 people were plunged into an icy pond and only two developed pneumonia, by this same reasoning we might say that, because 48 remained well, the shock and exposure were not causative factors in the development of the pneumonia in the two who contracted it.

The great argument advanced by Segond against the admissibility of trauma as a causative factor in malignant disease is, the absence of any definite knowledge of the condition of the parts prior to the accident. In order to have such knowl-

edge scientifically acceptable, he believes that there should be evidence of a medical examination of the locality prior to the injury, and such evidence, he states, is entirely lacking, there being no such cases.

My own series of cases supplies this deficiency in at least four instances:

1. The case of the sarcoma of the humerus; injury producing a fracture of the upper and middle third; X-ray showing absolutely normal structure of bone. Six weeks later another X-ray showing a well-developed sarcoma at the exact site of the fracture.

2. Sarcoma in the groin, starting at the exact site of a hernia incision made four weeks before.

3. Sarcoma, starting in the fascia about the external malleolus three weeks after the trauma incident to the stretching and tearing of the fascia and ligaments, due to the forcible correction of a flat-foot.

4. Sarcoma of femur, in a girl nine years of age, the daughter of a surgeon.

Phelps quotes Billroth: "In no single instance has a tumor been caused intentionally by chemical or mechanical irritation."

Yet, at the very time when Phelps's paper was being published, Clunet of Paris was actually producing a malignant tumor in a rat, experimentally, by the irritation of the X-rays. Clunet subjected a certain definite area in the rat to periodical and prolonged exposures to powerful X-rays, allowing the ulceration to heal before the next irradiation. At the end of five months, the ulcerated surface, instead of entirely healing, became greatly thickened and soon developed into a malignant tumor which killed the animal. Furthermore, the large number of cases of cancer (epithelioma or carcinoma) of the hand, in X-ray workers, directly disprove Billroth's statement. The fact that they were not produced intentionally none the less prevents us from classing them as caused by mechanical or chemical irritation.

Phelps states that, "these tumors (examples of acute traumatic malignancy) in the great majority of cases, if not in all, are sarcomata, as were both of Billroth's and two of Coley's."

The statement as regards my own cases is extremely misleading, inasmuch as the subject of the paper from which the cases here quoted were taken was "The Influence of Injury upon the Development of Sarcoma." The paper dealt with sarcoma alone, simply referring to two striking examples of acute traumatic malignancy in carcinoma, without giving any analysis or even the number of cases of trauma associated with carcinoma, of which I had a large number even at that time. That just as striking examples of acute traumatic malignancy occur in carcinoma as in sarcoma, a glance at my series of cases will show.

Cases I to V fulfil the conditions laid down by Segond.

CASE I.—*Sarcoma of the humerus.*

Mr. L., thirty-five years of age. No history of cancer in the family; a man of splendid physique, 6 ft. tall, weighing 180 pounds. Early in January he fell and received a spiral fracture of the left humerus at about the junction of the middle and upper thirds. He was treated at the Hudson Street Hospital, and then returned to Baltimore, where he was treated by Dr. W. A. Fisher. An X-ray taken at this time showed a spiral fracture without any trace whatever of a new growth. Two to three weeks later he began to have severe pain at the site of the fracture. Another X-ray photograph was taken, showing that in the meantime there had developed a well-marked tumor, apparently a sarcoma, involving both the central portion and the periosteum. The growth increased rapidly in size, and was accompanied by very severe and constant pain.

In June, 1910, an exploratory operation was performed by Dr. J. M. T. Finney, of Baltimore, who found a large sarcomatous growth, involving both the central and periosteal portion of the humerus and extending from about the junction of the middle and upper thirds nearly to the head of the bone. The bone was completely destroyed; a pathological fracture had occurred and there was a flail joint. The central portion of the tumor was curetted; in Dr. Finney's opinion amputation offered no hope of a cure.

A few days later the patient came to me for the treatment with the mixed toxins. The treatment was begun on June 16, 1910, and continued in small doses, most of them being given

systematically, in the pectoral region and a few in the arm. There was slow but steady decrease in the size of the tumor and immediate cessation of the pain, which had been constant from the first appearance of the tumor. The shell of bone about the tumor, which had undergone spontaneous fracture, gradually became harder with the formation of new bone, and within a few weeks complete union had occurred. The large cavity gradually filled up with granulations. Several curettements showed the material to be sarcoma of the same type as the original tumor, namely, spindle-celled. The pathological examinations were made by J. C. Bloodgood of Johns Hopkins and also by James Ewing, Professor of Pathology at Cornell University Medical School.

Another X-ray examination in the latter part of 1910 showed that the new growth had apparently entirely disappeared and there was firm union of the arm. The patient's general condition was excellent. In November, the granulations began to increase again in size and in spite of curetting quickly recurred. An X-ray taken in December showed a small shadow starting in the periosteum, in the axillary region, and I finally decided, early in January, to do a shoulder-joint amputation. This was performed at once and the patient is at present well.

The case is here given somewhat in detail for the reason that all the conditions necessary to establish a direct causal relationship between the injury and the development of the growth are present.

CASE II.—Unique case of sarcoma of jaw and groin, having important bearing on the relationship of trauma in the development of sarcoma.

J. R., male, six years old, was admitted to my service at the Hospital for Ruptured and Crippled, Feb. 20, 1910, as a simple case of left inguinal hernia. The family history was good, and he was operated upon by the house surgeon for an uncomplicated left inguinal hernia. The wound healed by primary union, and he was discharged at the end of three weeks in perfect condition. April 15, he was re-admitted (Dr. Wm. A. Downes) to the hospital, for a large swelling in the inguinal region, directly under the hernial incision, extending from the anterior superior spine to the upper scrotum, not involving the testicle. The swelling was entirely painless and was first noticed a week before by the

family physician, who had been called in for what was supposed to be an ulcerated tooth, who on examining the patient detected this swelling in the region of the hernial scar. He had been a week before to the Presbyterian Hospital Dispensary on account of the supposed ulcerated tooth in the left upper jaw, just mentioned. He was sent to another hospital where they have a dental surgeon who removed two teeth and sent him home.

Physical examination, April 17, 1910, showed the right upper jaw markedly enlarged, the enlargement being in the alveolar process and not in the antrum; two teeth were absent and two or three others quite loose, but the whole structure was perfectly typical of sarcoma, which diagnosis I positively made. Examination of the inguinal region showed a fusiform sausage-shaped swelling, about $4\frac{1}{2}$ inches long, extending from the left of the anterior superior spine down to the upper scrotum, the most protuberant portion being directly under the recent scar of the hernia wound. The skin was movable and not discolored; the swelling was non-fluctuating, without any tenderness, and exactly like a sarcoma in consistence rather than a hæmatoma or cellulitis which diagnoses had been made by some of the surgeons who had seen him.

I made an incision along the line of the cicatrix about $3\frac{1}{2}$ inches long, and immediately on going through the skin came down upon a structure which was absolutely characteristic of sarcoma, firm in consistence, whitish in appearance, slightly vascular, involving the subcutaneous fatty tissue and extending down to the internal oblique muscle beneath, apparently originating in the fascia of the external oblique, along the line of the incision; it extended the entire length of the incision and into the upper scrotum. I removed a considerable portion of it for microscopical examination, but the wide extent of infiltration made a radical removal quite impossible. After closing the wound, I then removed as far as possible, by curette and scissors, the tumor of the upper jaw, which was about the size of a small English walnut. It did not extend into the antrum, but involved the entire alveolar process, nearly to the antrum. This structure also was quite typical of sarcoma. One-half of the portions removed was sent to Dr. Jeffries, Pathologist of the Hospital for Ruptured and Crippled, who pronounced both small round-celled sarcoma; the other half of the portions removed was sent to Dr.

Ewing of Cornell University Medical School Laboratory, who reported as follows:

"May 24, 1910: Tumor of jaw, is a complex tumor very difficult to diagnose and badly crushed, so that the relations are impossible to reconstruct. I find in it areas of fibrous tissue, eroded bone, spaces lined by cylindrical epithelium, areas of tissue invaded by this epithelium as in embryonal carcinoma, and finally larger areas of malignant tumor tissue in which the cells are large, polyhedral, and densely staining. This is evidently a complex tumor, and the presence of epithelium lined spaces and dense fibrous tissue suggest that it arose from a remnant of a tooth follicle or from the epithelium of the antrum. Without an accurate statement of the parts of the jaw involved, it is impossible to give any report on the nature of the jaw tumor, but it seems quite possible that it is the same sort of a tumor as the growth in the groin.

"The growth from the groin is a lymphosarcoma arising in the lymph-node and involving the surrounding fat tissue. Both tumors are quite malignant."

Two other specimens, one from the tumor in the inguinal region and one from the tumor in the upper jaw, were examined by Dr. F. M. Jeffries, Pathologist to the Hospital and Professor of Pathology of the New York Polyclinic Medical School and Hospital, who pronounced both small round-celled sarcoma.

This case I believe to be absolutely unique, and I think it has a very important bearing upon the part which trauma plays in the etiology of malignant tumors. It would seem possible that the sarcoma in the upper jaw was the primary growth, which, however, did not reach sufficient size to call any one's attention to it until after the operation for hernia. The trauma incident to the operation so lowered the vitality or resisting powers of the tissues in the vicinity of the wound that they furnished a favorable nidus for the secondary development of a sarcoma, the causative agent of the sarcoma, whether it be a parasite or infected cell, being carried to this locality through the blood current. These cells or parasites were probably in the circulation before the time of the local trauma, but the normal tissues had sufficient resisting power to prevent a local infection.

The patient was put immediately upon the mixed toxins of erysipelas and *Bacillus prodigiosus*, the dose being carried up

gradually to 5 mm. Before a reaction could be produced, owing to some family troubles, he was taken away from the hospital two weeks from the time of his entry. In this short time, however, the disease had advanced with great rapidity, extending up into the orbit, causing almost complete closure of the eye and also extending up into the glands of the iliac fossa, and it caused the death of patient in three months.

CASE III.—*Sarcoma of ankle, developing immediately (within two weeks) after forcible correction of flat-foot.*

F. K., male, sixteen years of age. Good family history; always well up to December, 1909, when he came to the Hospital for Ruptured and Crippled, service of Dr. W. R. Townsend, for treatment of flat-foot. At this time careful examination showed nothing whatever abnormal outside of the flat-foot. Both feet were forcibly stretched by Dr. Arthur Cilly and placed in plaster-of-Paris bandages in a position of marked adduction. At the end of two weeks the bandages were removed, and there was found a well-marked circular swelling, about $1\frac{1}{2}$ in. in diameter, situated just below the external malleolus of the right foot at a point where the greatest strain to the ligaments had occurred during the stretching. The skin was normal in appearance; the tumor moderately firm in consistence, but not bony, firmly fixed to the underlying structures, apparently not connected with the bone. I saw the case a week later in consultation with Dr. Townsend, and we both agreed that it was almost certainly sarcoma. The tumor had by this time become $2\frac{1}{2}$ in. in diameter, with an elevation of $\frac{3}{4}$ in. above the normal surface; it was firmly fixed to the ligamentous structures.

The patient was referred to my service at the General Memorial Hospital. Under ether anæsthesia I attempted to excise the tumor, but as there was no capsule, and infiltration of the surrounding tissues in all directions, it was impossible to make a complete removal. It extended down to the bone, but unquestionably originated in the ligamentous structure rather than the bone or periosteum. A good deal of the tumor had to be left behind. The patient was then put upon the mixed toxins of erysipelas and *Bacillus prodigiosus* for two or three weeks, but the tumor continued to grow in spite of treatment. Four weeks later amputation at the junction of the middle and lower thirds of the tibia was performed, and the patient again put upon the

toxins as a prophylactic, for three months. He is at present in perfect health, nine months afterwards. (March, 1911: Patient has just developed metastases in the lungs.)

This case is one of the most conclusive as a demonstration of the causative effect of a trauma in the production of malignant tumor. As Dr. Townsend stated: "Here we have an example in which a sarcoma developed under constant and minute observation immediately after a trauma, almost as if one had planted a grain of corn and watched it germinate."

CASE IV.—*Acute subperiosteal spindle- and round-celled sarcoma of femur.*

M. B., age nine years (March, 1907). Daughter of a prominent physician.

Patient always in perfect health up to 2½ weeks ago, when she fell from a bicycle. Ten days later she began to complain of pain just above right knee. Physical examination showed a small tumor apparently connected with the femur, just above the inner condyle. This grew very rapidly. Exploratory incision and microscopical examination made three days later showed it to be subperiosteal and mixed spindle- and round-celled sarcoma. I saw the patient six days after the tumor was first noticed and found a bony tumor involving the whole circumference of the lower end of the right femur; more marked on the inner side, extending up for five inches; circumference two inches more than other side. Mixed toxins were given for ten days but failed to control the rapid increase in size. Amputation within two weeks from time I saw her. Generalization within three months. Death four months from time of injury.

CASE V.—*Sarcoma of the humerus; acute traumatic malignancy.*

H. L. B., male, age ten years (March 16, 1910). Family history good.

Five weeks ago patient fell on the ice and struck on his left shoulder and upper arm. He immediately lost power of the arm and a medical examination showed a fracture about the junction of the middle and upper thirds of the left humerus. Three weeks later his doctor found a marked swelling on site of fracture, which he took to be redundant callus. This arm increased rapidly in size and at my first examination two weeks later, five months from date of injury, the whole upper portion

of the left humerus was enormously enlarged. Skin covered with greatly dilated, bluish veins. Tumor extended inwards under the pectoral muscle and backwards over to the scapula. X-ray photograph showed a typical sarcoma of the humerus at the site of a recent fracture. Two days later had an interscapular thoracic amputation. Patient made an interrupted recovery. Toxins given immediately after and kept up for five months. Patient well, March 1, 1911.

CASE VI.—*Acute traumatic malignancy; spindle-celled sarcoma of the breast.*

M. L. McL., thirty-four years old; single; in May, 1906, struck her right breast with a tooling instrument. She had a fear of cancer, and a short time after the blow began to worry about it. A week later she noticed a small swelling appearing at precisely the point of injury. The tumor could not have been present before the injury, because her anxiety with regard to the matter had made her watch it carefully in the meantime. The swelling grew very rapidly. It consisted of a movable lump attached neither to the skin nor deeper parts, and it was harder than the rest of the breast. Two months later she received three treatments with the X-ray in Paris. The tumor continued to grow rapidly and she came to New York.

I saw her in consultation with Dr. Parker Syms, July 23, 1906. Physical examination showed the entire right breast symmetrically enlarged and transformed into a large tumor double the size of the other breast. The tumor was soft and semifluctuating. She had had a temperature of 102° for three or four weeks prior to this time. A portion of the tumor was removed for microscopical examination, which proved it to be spindle-celled sarcoma. There were no enlarged glands. The breast was entirely removed and the axilla carefully cleaned out by Dr. Syms, and shortly afterwards the mixed toxins were administered under my direction, for a number of months. In spite of this a recurrence took place about a year later, and she died within 15 months after operation.

The following case of carcinoma is nearly if not quite as convincing, as there is little chance of the man having had a tumor of the face before the injury, and not noticed by himself or his friends.

CASE VII.—*Carcinoma of the face; acute traumatic malignancy.*

L. F., male, forty-nine years of age, was referred to me on June 5, 1908, by Dr. C. A. Bleiler. There was no family history of cancer. The patient had been in perfect health up to May, 1908, when he was struck over the right malar region by a strong lever while at work on a train (he was a railroad employé). A swelling developed immediately after the blow; he consulted a physician the same day. The following morning poultices were applied and these were continued for two weeks. The swelling continued to gradually increase in size, and finally became ulcerated over its central portion. Physical examination on June 5, 1908 (a little over three weeks after the injury), shows the patient about forty-five years of age, of strong physique and perfect general health. On the right side of the face in the malar region is a tumor the size of a goose egg, movable upon the deep parts, apparently originating in the muscle and fascia. The skin is very much reddened, and in the centre there is an ulcerated area about $1\frac{1}{2}$ in. in diameter; free hemorrhage on removal of the dressing; no enlarged glands.

Although the case seemed nearly inoperable, I intended to remove the growth, if possible, and operated the following day. It was impossible to remove the entire tumor and a portion had to be left behind. The patient was immediately put upon the mixed toxins. In July the remaining portion of the tumor could be removed by my associate, Dr. Downes. In spite of these operations and the toxin treatment, the tumor very quickly recurred and the patient's general health soon became affected. The treatment was discontinued. The disease progressed with great rapidity and caused death within three months from the time of the injury. Microscopical examination was made by W. C. Clark, Pathologist to the General Memorial Hospital, and by James Ewing, Professor of Pathology at Cornell University Medical School, who pronounced the disease carcinoma.

The following case of Schöppler's also fulfils every condition laid down by Segond and Phelps.

Schöppler (*Zeitschr. f. Krebsforschung*, Bd. x, Hft. 2, 1911) reports a case of carcinoma of the breast, following a single trauma in a previously healthy woman who had been examined by him a few days before the injury. Schöppler

states that while there are those who, in the case of a supposedly traumatic cancer would go so far as to refuse to accept as convincing any statement regarding the previous health of the parts in question, except such previously healthy condition has been proven by the *microscope*, he believes that a preceding *clinical* examination of the parts involved ought to be sufficient to justify one in excluding a pre-existing diseased condition of the tissues. It is this latter condition that has been fulfilled in the case observed by himself:

The patient, a woman thirty-six years of age, who had always enjoyed perfect health, came to him in the first days of March, 1909, believing herself to be pregnant. He made a thorough examination and found no pathological changes present. On March 10, this woman fell down-stairs, injuring her left breast. The resulting pain in the breast was so severe that she called in Dr. Schöppler the next day. He found in the outer portion of the left breast a sensitive, slightly ecchymotic area. In a week's time the sensitiveness and suggilation had disappeared. End of April Schöppler was again called to see the patient who had been noticing a hard swelling to appear at the exact site of the injury, which had by this time reached the size of a hazel-nut. Operation advised by Dr. Schöppler was refused by the patient. The tumor continued to grow rapidly, and by the end of May had reached the size of an apple. She then consented to removal of the tumor. The pathologist pronounced the growth an intracanalicular sarcoma. Examination end of July showed no trace of a tumor, but by the middle of August, two tumors began to develop in the glandular tissues near the scar and by the beginning of September extended over the entire breast. Amputation of the latter was done and microscopical examination proved it carcinoma simplex of the left breast.

Dr. C. B. Lockwood, in a lecture delivered at St. Bartholomew's Hospital on June 8, 1910 (*The Lancet*, Aug. 13, 1910, p. 445), on "Fibroma, Sarcoma, and Fibromyoma of the Abdominal Wall," stated in connection with the information volunteered by one of his patients, that she had received a severe blow at the site of the tumor two years before: "I do not think it is right altogether to ignore this history of a blow or an injury. An injury results usually in the extravasation of blood. Extravasation of blood brings about inflammation, and inflammation brings about tissue changes, and these tissue changes may bring about cell multiplication, and this cell multiplication may run wild and result in the forma-

tion of a tumor. I cannot help believing that in the breast a blow is sometimes the preliminary to the formation of carcinoma, because a blow results in the extravasation of blood; an extravasation of blood inflames the breast tissue, and the result is a chronic mastitis. The epithelium of the acini or of the ducts proliferates, just as the epithelium of the tongue does, and goes into the lymph spaces and onward into the lymphatic glands. Seen at that stage, you would say that the patient had carcinoma of the breast. It is conceivable to me that a similar course of events might lead to the proliferation of the connective-tissue cells of the abdominal wall and to the production of a fibroma, or even of a sarcoma. There is no evidence that these tumors are ever due to anything introduced into the body. But again, I would not draw too wide inferences from the absence of evidence on this point. Certainly, things introduced into the body can produce tumors of considerable size. The *Spirochæta pallida* introduced into the body can cause gummata, which have over and over again been mistaken for sarcomata. So that if any of you attempts to investigate the production of sarcomata, you should not, I venture to suggest, ignore those possibilities."

The recent experiments of Carrel, part of which have been briefly published recently, for the first time showing that human sarcoma cells can be made to grow outside of the human body, throw some light on this vexed question. Such cells grow only under the most favorable environment, the very slightest infection immediately inhibiting their growth, and the patient's own blood plasma being the medium upon which they thrive best. It is not difficult to understand that an injury, and even an insignificant injury, by producing a slight extravasation of blood may cause just the culture medium for the abnormal growth of the cells.

(To be Continued)

THE ABDUCTION TREATMENT OF FRACTURE OF
THE NECK OF THE FEMUR, WITH ESPECIAL
REFERENCE TO THE ADVANTAGES OF THE
SEMIRECLINING POSTURE AND CHANGES OF
ATTITUDE IN ITS APPLICATION TO ELDERLY
SUBJECTS.

BY ROYAL WHITMAN, M.D.,
OF NEW YORK.

A WOMAN, seventy-three years of age, was seen on December 13, 1909. Three days before she had been thrown down by a street car and had been taken to a hospital, where a diagnosis of fracture of the neck of the femur was confirmed by an X-ray picture. After removal to her home the long side splint which had been applied at the hospital was replaced by sand bags; in the opinion of her physician, an equally efficient and less burdensome support.

The patient presented the distortion and helplessness of the limb characteristic of fracture of the neck of the femur, with a displacement of the fragments indicated by one and a half inches of shortening. As she was the mother of a physician, the question of treatment was particularly embarrassing to an advocate of an unorthodox method. The advice of the other consultants followed the accepted teaching, that treatment was hazardous and that even if it were efficient, union was very improbable.

On the other hand, some support was required because of pain on movement, and if this might hold the fractured surfaces in contact one might at least hope for repair as contrasted with certain disability, a moral support both to the surgeon and to the patient that is not generally appreciated. It was decided therefore to apply the abduction treatment.

Although this has been described many times, neither its principles nor its details are clear even to some of those who criticize it, and I shall take this opportunity, therefore, to again explain them.

It is essential for restoration of function that deformity be reduced, and for union that the fractured surfaces be fixed in contact. As one has no control over the inner fragment, contact can be assured only by adapting the outer fragment to it. To accomplish this the patient must be anæsthetized. The shortening is then reduced by direct traction, the thigh having been lifted to the proper plane. It is then abducted to the normal limit (Fig. 1).

1. Abduction turns the fractured surface of the neck downward to meet that of the head.

2. Abduction makes the capsule tense and aligns the fragments.

3. Abduction relaxes the muscles whose contraction tends to displace the fragments.

4. Abduction apposes the trochanter to the side of the pelvis, or, if the fracture is near the head, engages the extremity of the neck beneath the rim of the acetabulum and thus provides a mechanical check to displacement.

5. In what are classed as successful results of treatment by routine methods, in the sense that union has been obtained, there is almost invariably limitation of abduction to a degree sufficient to cause disability. This depends primarily upon unreduced deformity, but it is increased by the muscular adaptation to the median position in which the limb has been fixed during treatment. Fixation in the attitude of full abduction assures, therefore, the conditions most favorable to functional recovery.

What is classed as impacted fracture is, usually, a complete fracture with but slight displacement. In most instances, whether the fragments are adherent or not, the essential deformity is a loss of the upward inclination of the neck upon which the range of abduction (45 to 55 degrees) depends. For the anatomical limit of abduction under normal conditions is reached when the neck, approximately in the horizontal plane, comes into contact with the upper surface of the acetabulum.

The range of abduction, therefore, is limited, in degree corresponding with the lessened angle (coxa vara), and this

limitation is still further increased by muscular adaptation. Functional disability is thus inevitable unless a sufficient angle is restored.

Correction of deformity is usually described as the "breaking up" of an impaction, apparently a violent manipulation designed to separate firmly adherent fragments. Once separated, repair is doubtful because apposition cannot be assured by the means usually employed. Under such conditions the advice, that contact shall not be disturbed, is sound. The abduction method, however, enables one to correct the deformity to the degree that is practicable, without danger.

The patient having been anæsthetized is placed on the pelvic rest, the limbs being supported in the manner to be described. The shortening is then reduced by direct manual traction, aided by pressure on the projecting trochanter, the limb being rotated inward so that the position of the foot corresponds to its fellow. It is then slowly abducted under traction to the desired degree, preferably to the normal limit.

In most instances no force whatever is required, in others, particularly in the class seen in early life, in which the fracture is incomplete, the deformed neck coming into contact with the upper border of the acetabulum is fixed, and one may, by means of the leverage of the extended limb and the fulcrum furnished by the rim of the acetabulum at the seat of the injury, on further abduction restore the normal relation between the shaft and the neck.

In the ordinary type of the epiphyseal fracture the neck is displaced upward and forward in its relation to the head and is often adherent to it. Thus forcible and repeated abduction and inward rotation may be required to disengage and replace the fragments, failing in which an open operation is indicated as described in previous papers.

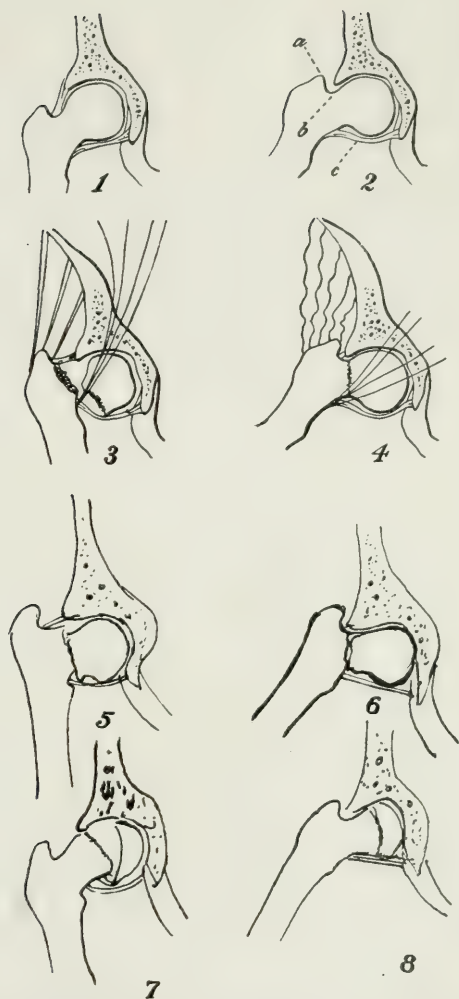
The application of the abduction treatment in the case under consideration was in detail as follows: Seamless shirting was first fitted to the body and limb to permit the use of friction bandages, two of which were inserted. The patient having been anæsthetized was lifted carefully to a table, the shoulders resting on

a box, the pelvis on a firm sacral support, the two limbs being held in the extended position by assistants. The assistant supporting the sound limb then abducted it to the full limit (about 45 degrees), reached when the upper border of the neck and the inner surface of the trochanter came into contact with the rim of the acetabulum. The operator then flexed the thigh on the injured side and rotated it inward, with the aim of disengaging the fragments from the capsule. It was then extended and supported from beneath while the assistant, applying steady traction, easily drew the trochanter down to its normal relation with Nélaton's line and to the anterior superior spine. It was then abducted to the full limit, the sound limb serving as a model both as to rotation and abduction. Final inspection showed the anterior spines in the same plane, the limbs symmetrical in equal abduction and of equal length by measurement. In this attitude the body is easily balanced on the sacral support by the widely separated and extended limbs, and a very moderate degree of traction aided by the tension on the capsule and the pressure of the trochanter on the lateral tissues of the pelvis will prevent displacement.

In cases of recent fracture the shortening is very easily reduced in the manner described, the pelvis being fixed by the hands of the operator. If there is more resistance, a folded sheet is passed between the limbs and an assistant, standing by the anæsthetist on the injured side, holding the two ends provides countertraction. The only essential apparatus is a firm pelvic rest, that shown in the photograph being the best. An efficient support may be cut from strong sheet steel, the sacral part approximately the size and shape of a hand, with a base bent to the same plane and screwed to a board (Fig. 2).

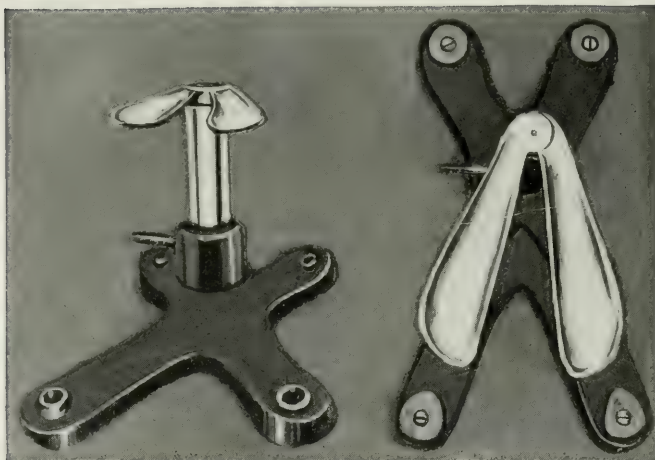
The body and limb were firmly and smoothly covered with sheet wadding and cotton flannel bandages, all bony points being carefully protected. A long plaster spica support was then applied from the toes to the axillary line, accurately moulded about the trochanter, enclosing and supporting the entire buttock, and strengthened beneath the hip by a band of steel of the size and shape of the Thomas hip splint. The entire procedure was completed in half an hour. The anæsthetic caused no disturbance and the support no especial discomfort. The following day and at intervals thereafter the patient was turned completely over upon her face to relieve the back, care being taken to hold the

FIG. 1.



Diagrams to illustrate the text. 1, the normal hip-joint. 2, The anatomical checks to abduction; *a*, impact of the trochanter and the ilium (muscles intervening); *b*, contact of the neck with the rim of the acetabulum; *c*, tension of the capsule. 3, the deformity of complete fracture and the influence of muscular contraction. 4, reposition by traction and abduction, showing muscular relaxation and changed direction. 5, incomplete and impacted fracture illustrating coxa vara deformity. 6, reduction of deformity by abduction. 7, 8, epiphyseal fracture and separation with reduction.

FIG. 2.



Schultze's pelvic rest.

FIG. 3.



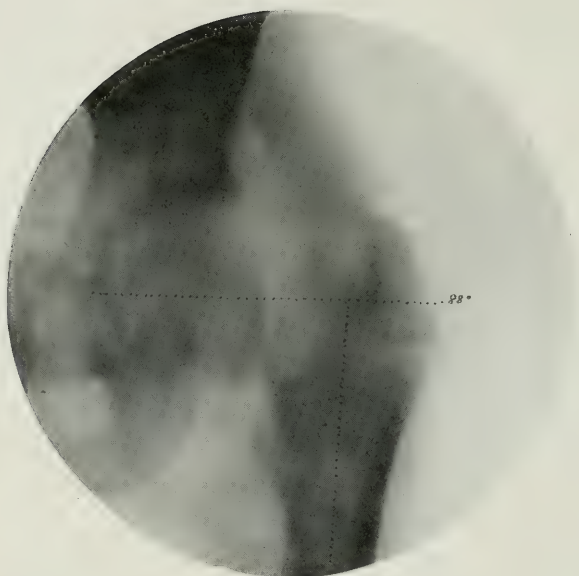
The elevation of the head of the bed (25°) to provide a semi-reclining posture and thus to lessen the danger of thoracic congestion and to improve the nutrition of the injured part.

FIG. 4.



X-ray picture, six months after the accident, shows the process of repair. The fracture is of the intracapsular type in which bone absorption and non-union are, it is taught, practically inevitable in patients of advanced years.

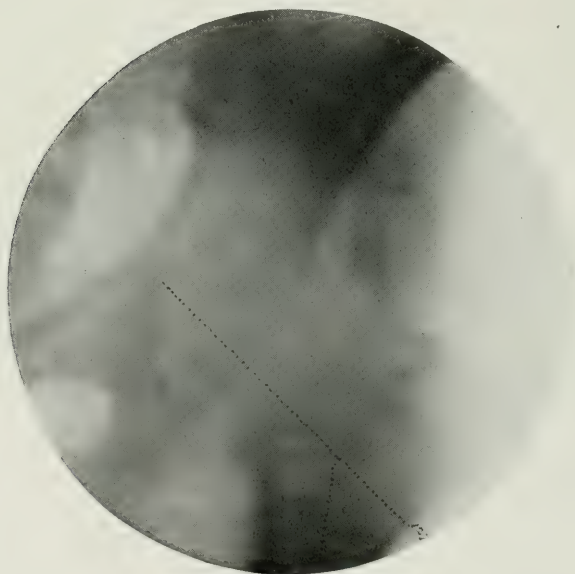
FIG. 5.



A series of pictures (5-9 inclusive) illustrating the treatment of fracture of the neck of the femur.

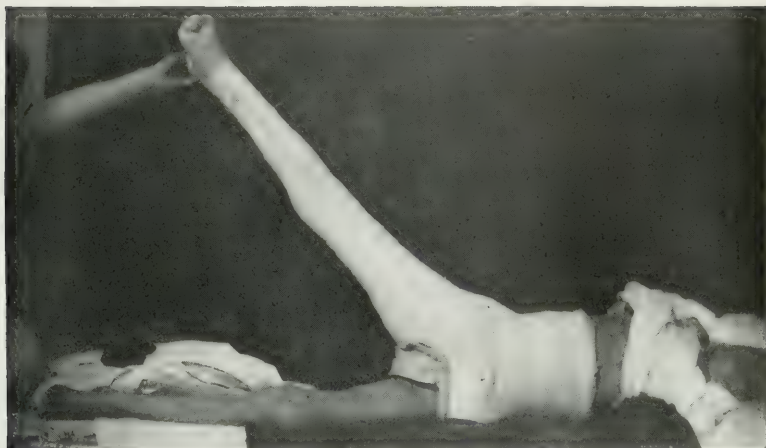
This figure shows the deformity of complete fracture. The patient, a girl 14 years of age, was first seen in August, 1910, three weeks after the injury, a fall from a swing.

FIG. 6.



X-ray taken six months later, showing reduction of the deformity.

FIG. 7.



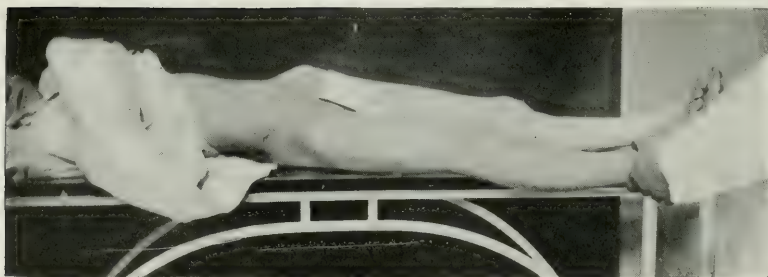
The plaster spica holding the limb at the limit of normal abduction, illustrating the adjustment to the pelvis and to the hip.

FIG. 8.



The traction (caliper) hip-brace used as a protective apparatus. The upright is so adjusted by means of the key that no weight falls upon the heel.

FIG. 9.

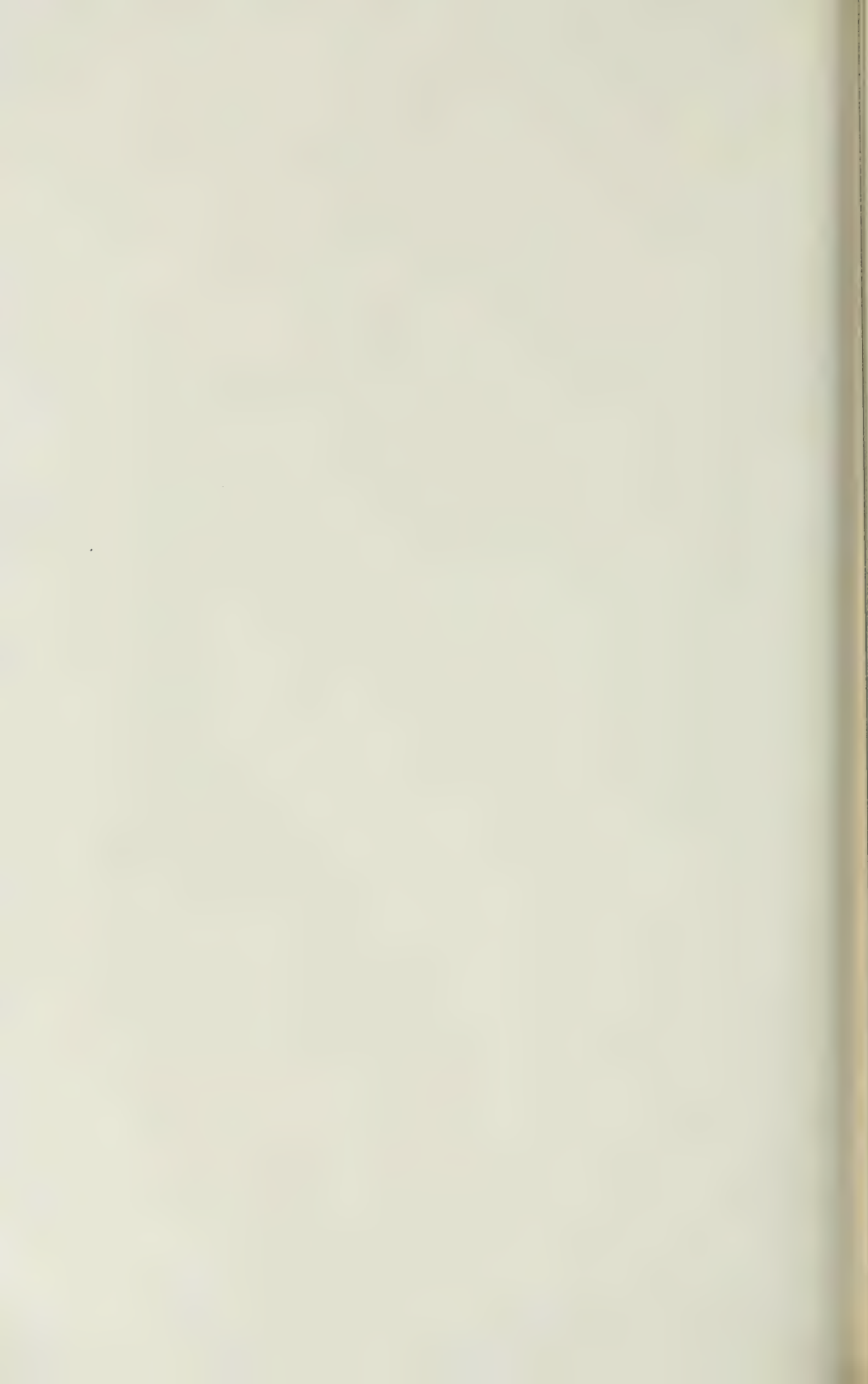


Illustrating the most important detail in the after-treatment, drawing the limb outward to the attitude in which it had been fixed by the plaster spica. This patient was examined on March 16, 1911. A perfect functional cure has been attained.

FIG. 10.



Fracture at the base of the neck in a child 3 years of age. Seen in August, 1910. Treated with perfect success by the abduction method. In untreated cases of this class the deformity is increased by functional use.



limb in its exact degree of abduction, so that the upper part of the support might not press uncomfortably on the thorax.

As the particular danger of treatment of elderly subjects is said to be hypostatic pneumonia, the head of the bed was raised as shown in the photograph (Fig. 3), the height varying with comfort of the patient, that illustrated being from 20 to 25 degrees or one-quarter the distance from the horizontal to the perpendicular. At this inclination the patient sometimes complained of discomfort in the hip and tension in the limb caused by "rush of blood." Thus the elevation of the head of the bed provided a semireclining posture with its obvious advantages, and at the same time assured congestion which should favor repair, as contrasted with the elevation of the foot of the bed required when traction is employed.

The patient was, for her own satisfaction, supported in the upright position during the fourth week. The upper half of the spica was removed in eight weeks, leaving the lower section as a support for a week or more longer. The limbs were then of equal length by measurement. There was no local deformity.

The accompanying X-ray picture (Fig. 4) taken six months after the injury shows the seat of the fracture in process of repair and the comparative symmetry attained. At the present time there is no deformity, no shortening, practically no limitation of motion, and the patient walks with a cane with but slight limp.

The after-treatment of fracture of the neck of the femur is only secondary in importance to the reduction of the deformity. Repair must be slow and functional recovery is delayed by the involvement of the joint in the injury and in the process of repair (Fig. 5). Furthermore the neck of the femur is exposed to much greater strain than are other bones, and the early use of the limb to which patients are encouraged, particularly when the fracture is thought to be impacted, increases the direct deformity and thus further deranges the mechanism of the joint. This, together with the nutritive changes following the injury, are the chief causes of the local distortions classed as traumatic arthritis deformans.

A more common cause of unnecessary disability is adduction of the limb, often combined with flexion. This is in-

duced primarily by unreduced deformity, but it is exaggerated by voluntary and involuntary adaptation to the weak, disorganized, and sensitive articulation. Weight should not be supported directly for at least six months, nor until voluntary and passive movements are relatively free and painless (Fig. 8).

By far the most important manipulation in the after-treatment is to draw the limb out to the position of abduction in which it was originally fixed several times during the day. This should be begun immediately after the spica is removed, and continued until the patient has regained the ability to place it in the desired attitude. If this is neglected, the range of abduction lessens very rapidly, the attitude of adduction and flexion being, as has been stated, the natural adaptation to weakness and discomfort (Fig. 9). This emphasizes the disadvantage of fixing the limb for many weeks in the median line as in the routine methods of treatment, since muscular retraction is in itself a very important factor in increasing the disability generally supposed to be inevitable after this injury.

If the range of abduction of the extended limb can be preserved, which implies of course primary reduction of deformity, the other movements will be regained without especial effort. This is of importance, since the ordinary attendant may be taught to draw the limb outward to the attitude which the plaster support has made familiar, whereas the manipulations required to overcome muscular retraction and the like require more skill and experience than are usually at the command of patients of this class. This calls attention again to what has been tabulated as the fifth advantage of the abduction method.

In the numerous papers that I have written on this subject, the argument has been confined thus far to the technical treatment of the injury, by the exclusion of all cases in which the physical condition of the patient might prevent or modify the treatment of the fracture as a fracture. The purpose has been to present a direct contrast to the accepted teaching in which the obstacles to success are exaggerated by mislead-

ing statistics and by questionable inferences. For example, fracture of the neck of the femur caused by slight or indirect injury is classed as peculiar to old age and is explained by local atrophy, while fracture in the vigorous subject is supposed to be caused usually by direct violence that injures the bone beyond the possibility of repair. In old age, impaired nutrition makes repair doubtful. In middle life, crushing of the bone prevents restoration of function, while the fracture in youthful subjects is ignored.

As a matter of fact, however, the neck of the femur is mechanically a weak point in the skeleton. Under the general atrophy incidental to age, the weak point becomes relatively weaker and more liable to injury because of insecurity of the gait. But, as has been stated, it has always been weak, and therefore it may be broken at any age by slight force advantageously applied, a particularly susceptible period being adolescence.

In the elderly subjects, the character of the injury is unmistakable. The favorable class, however, because of failure of diagnosis and for other reasons, is inadequately represented in the hospitals where official statistics are compiled. The aged and feeble are unfavorable subjects for any treatment, particularly so for that of this fracture. Yet this class has set the standard, which is only varied as to quantity when applied to the vigorous patient. Its application is essentially perfunctory, and the disregard of surgical principles from beginning to end is a sufficient explanation of the disability supposed to be inevitable after this fracture.¹

Under questionable inferences, as applied at least to the class of cases suitable for treatment, may be included inability for repair because of the effect of age on the blood supply, supposed to be furnished by the ligamentum teres, the spon-

¹ "Our prognosis in cases of fracture of the neck of the femur must always be unfavorable. In many instances the injury soon proves fatal, and in all the functions of the limb are forever impaired; no matter whether the fracture has taken place within or external to the capsule, whether it is united by ligament or bone, shortening of the limb and lameness are the inevitable results."—R. Smith.

taneous absorption of bone, and the effect of the synovial fluid in preventing union.

What is certain of this fracture may be summarized as follows: Of all injuries of this class it is by far the most difficult to treat: because of the physical condition of a large proportion of the patients; because of the situation of the injury, which necessitates constraint of the body as well as of the limb; because of the shape, position, and relation of the fragments which make apposition difficult to secure and to maintain; because nutrition is feeble. Thus repair is dependent upon accurate adjustment and it requires many months for its accomplishment. Whether the proportion of cases in which failure is inevitable, although every condition for success has been fulfilled, be large or small, is purely conjectural because these conditions have never been assured.

The observation of deformity, disability, and non-union following fracture of the neck of the femur in youthful subjects long since convinced me that these were essentially penalties for inefficient treatment, since there could be no question of the inherent capacity of the tissues for repair. It was in this officially non-existent class that the abduction method was tested before applying it to older subjects. Its relative efficiency as a means of correcting deformity, in apposing and fixing the fragments, and its practicability as a basic treatment for all types of the injury have since been demonstrated in many cases, by direct observation at open operation, by X-ray pictures, and by functional cures that have been attained by others as well as by myself.

Now for the first time the application of the abduction method in the treatment of elderly patients, who are considered proper subjects for local treatment, is advocated, since it would appear that it is not only the most effective, but, because of the changes of posture that it permits, the least dangerous of methods. In each case of this class the treatment must be considered as an experiment, to be continued or abandoned according to the indications, and, in the absence of reliable evidence, one is justified in at least hoping for repair.

Fracture of the neck of the femur if for no other reason than the time required for treatment is out of place in a hospital ward. Fortunately the abduction method is well adapted to private practice, for although the procedure is somewhat of the nature of an operation, once applied, constant and skilled attention is not essential to success.

The abduction treatment represents a new point of view,² namely, that the proportion of cases in which efficient treatment is practicable has been grossly underestimated; that the results in this, as in other fractures involving joints, depend primarily on the restoration of normal contour, and that the reduction of deformity is not only essential to functional recovery, which should be the aim in treatment, but that it offers the best, and in complete fracture, the only, assurance of union.

The method which enables one to apply these principles has received its distinctive name because of the means employed to reduce deformity and from the attitude in which the limb is fixed after this is accomplished. It is not properly classed as a "plaster-of-Paris" treatment, since braces or traction even might be used to assure the position.³ The plaster spica is, however, the only support generally available. If properly applied, it is more efficient and more comfortable than routine methods, of which the bed is the essential part of the apparatus and in which unrelieved rest upon the back is required. If the direct restraint of the spica is greater, it is more than compensated by the freedom from discomfort on movement, and by the relief assured by the changes in attitude that it permits. It is therefore, contrary to the prevailing opinion, the most efficient preventive of pressure sores.

The abduction method should be used with discrimination,

²"The attainment of the ideal object of treatment, restoration of form and function, is rarely to be expected or even sought. . . . The first indication is to save life, the second to get union, the third to correct or diminish displacements."—L. A. Stimson.

³Robert Jones uses a modification of the double Thomas hip splint for this purpose. *Proceedings of the Royal Society of Medicine*, December, 1910.

both as to the selection of suitable cases and in adaptation to the local conditions. It is perhaps needless to say that the comfort of the patient and the effectiveness of the treatment are dependent in great degree upon the proper adjustment of the support. Although experience, therefore, is as desirable in this as in other surgical procedures, it would seem that an intelligent novice might apply a treatment whose objects are definite and whose effects are demonstrable, with better prospect of success than more familiar methods in which no attempt is made to assure the primary essentials for union, and which have been so discredited by practical experience that a large proportion of the patients receive no treatment whatever.

The purpose of this paper is to call attention to the advantage of elevating the head of the bed, which by increasing the blood supply of the lower extremities should on the one hand favor repair, and on the other, lessen the danger of thoracic congestion. This advantage of the abduction method may increase its availability in the treatment of the less favorable class of cases.

The details of method have been reviewed for the benefit of those who may be dependent upon the inadequate and incorrect descriptions that appear in the text-books and in special treatises on the subject.

FRACTURES OF THE SHAFT OF THE FEMUR WITH MARKED DISPLACEMENT.*

BY RICHARD H. HARTE, M.D.,

OF PHILADELPHIA,

Surgeon to the Pennsylvania Hospital.

It would appear that fractures of the shaft of the femur have not received the careful attention and study which they merit, perhaps because it is rare that a surgeon in active professional life sustains an injury to this bone, with the possible exception of those who ride horseback, or, again, it may occur as the result of an automobile or railroad accident.

Much time and consideration have been given to the study of enlarged prostate, appendicitis, and like pathological conditions, to any of which all classes and professions are liable. And, with these commoner affections constantly in mind, it is little wonder that the femur should not, of late years, have received the attention which it really deserves.

Fracture of the shaft of the femur is not, on the whole, a very common injury, and our experience in its repair is almost entirely confined to our hospital practice rather than in our private surgical work. Of course, it must be understood that we are dealing with fractures of the shaft of the bone occurring in the active years of life and not with fractures of the neck of the thigh, which occur so commonly in persons past the meridian.

The question now to be considered, in a measure, after an accident of this description is: *Is the limb after treatment in as good condition and position as it was before the accident, following what is accepted as good results?*

It is the generally accepted opinion that from one-half to one inch shortening of the limb is a fairly satisfactory result,

* Read before the Philadelphia Academy of Surgery, December 5, 1910.

but with this we shall often find considerable rotary displacement and angularity, which, if low down, frequently interferes with the function of the knee-joint, due to an excess of callus, which can be readily felt at the seat of injury.

A careful study of the museum specimens of this injury is very instructive and is calculated to modify one's previous conception of what actually takes place and what constitutes a good result.

I think the general belief among many surgeons (who should know better) is, that with general anæsthesia, it is quite possible in a transverse fracture to get good end-to-end apposition of the fragments and keep them in perfect position by means of weights and pulleys, sand bags, etc., and that a nice, spindle-shaped lump of callus will surround and hold the ends of the broken bone together, and that the leg will be as good as ever after the injury.

It may seem a homely comparison, but no person of reasonable intelligence would say that the broken leg of a piece of furniture is as good or as perfect, no matter how well repaired, as it was before being broken. And the same analogy holds good as regards the femur that has been fractured.

Let us consider for a moment some of the actual conditions which confront us, as illustrated by an X-ray photograph or any selected museum specimen.

And here a word of caution must be offered in regard to the way in which the X-ray photograph is prepared. If the tube is not directly over the seat of fracture, the deformity may be enormously exaggerated, and it is always well to have the picture taken from several points of view, as an incredible amount of misinformation may be derived from the study of only one picture.

There is always varying degree of deformity, due to overlapping of the fragments.

The lower fragment may be either in front or behind, inside or outside the upper fragment, but is never exactly where it should be, if absolutely accurate reduction of the bone had been effected.

There is invariably a certain amount of rotation and the alignment is never absolutely perfect.

It is impossible to determine by the unaided eye, touch or measurements, what the actual displacement of the fragments is. The great mass of muscles surrounding the bone, the enveloping skin and fascia and possibly extravasated blood all combine to soften the irregularities of the real outline, just in the same way as a fresh fall of snow smoothes out and diminishes inequalities of contour in a landscape.

It is, therefore, impossible to gain any appreciable idea of the extent of bony displacement which exists in these injuries without first having a carefully prepared X-ray picture.

If one will carefully study a specimen, he will have little difficulty in understanding why these patients complain of pain and weakness in the limb, of lameness, of coldness and œdema of the feet, and why the functional activity of the limb must necessarily be greatly impaired. And careful thinkers must feel that a fracture of the femur in the active years of life cannot but be a serious injury, and should demand the careful consideration of all surgeons who are treating these injuries.

It seems to the mind of the writer that the time is ripe for breaking away from the old, accepted traditions and teachings of the great men of the past: to wit, that shortening of an inch or more is the inevitable outcome of such injuries, and that nothing can be done to prevent it.

In the words of Sir Thomas Myles, who has dealt very ably in an exhaustive paper on this subject, "Are we not bound, as surgeons, to avail ourselves of all the advantages that progress in other directions has made possible for us? Is the technic which has made safe the great operations in other branches of surgery not to be utilized in this important part of our work?"

I feel that, in dealing with all cases of fracture of the shaft of the femur in persons in the active years of life, the facts should be stated frankly and plainly to the individual, and he should be made to understand clearly the risks and advantages, on the one hand, and the freedom from risk

and the disadvantages, on the other, and it will be seldom that the active, intelligent patient will not decide to place himself in our hands, with the hope that the realization of the perfect result may be obtained.

Now the question arises: How are we to obtain the ideal result in the treatment of fractures of the shaft of the femur in persons who expect or hope to continue leading an active life?

I feel confident that there is no positive or definite line of treatment open to us, except the exposure of the fragments of the bone by a formal dissection and the restoration of the fragments, actually seeing the parts perfectly dovetailed back in their original position, which is positive assurance against rotary displacement and the first step toward procuring good alignment.

The X-ray is a perfect index of overlapping and shortening, but is of little or no use in determining the question of rotary displacement.

The writer is thoroughly aware, in urging this more radical method of treatment, that he is assuming a great responsibility, which may be diminished by certain limitations.

In the first place, the operation should not be undertaken except by skilled operating surgeons, who are in the habit of doing daily operative work in the hospital. This operation should not be undertaken in private houses, except under very perfect conditions, and should never be attempted on any but reasonably strong and healthy subjects. The operator should have at his command a perfect technic, with suitable instruments and skilled assistants.

Several methods might offer themselves for our consideration: such as wiring the fragments together; the introduction of an intermedullary splint; the use of absorbable pegs of bone or ivory, or some modification of Parkhill's screws and clamps; and lastly, the use of a steel plate and screws as recommended by Mr. Lane.

Time will not admit of discussing all the above mentioned methods, some of which are rarely employed.

The older method of suturing with wire, by drilling the ends of the bones and simply passing the wire around, has been in vogue for many years. It is open to certain objections, particularly in transverse fractures, as it does not retain the fragments in absolutely perfect position and presents more the character of a flail joint, and does not offer the amount of support that is so imperative in dealing with these cases.

However, in long oblique fractures, conditions are different, and the introduction of a wire through a hole drilled in the two fragments and then passing around the bone possibly two or three times to make a sort of ferrule, will suffice often to hold the splintered fragments in position.

Beyond this, the wire is not desirable in dealing with this class of injuries. The use of the wire can be facilitated greatly by using a heavy curved needle, which enables the operator to circle the bone without doing appreciable damage to the soft parts.

The plate and clamp method, as advocated by the late Dr. Parkhill, offers many advantages, insomuch that the wound can be practically closed and the plate left on the outside of the soft parts, and, after union has taken place, these screw supports can be readily removed and the wound will heal up in a very short time. It may, however, be open to the objection that the wound can never be absolutely closed during the process of repair; and it plays very much the same part, in the support of the femur or humerus, that the unfractured fibula does in the support of the tibia when the latter has been broken. It is a most ingenious method and deserves worthy consideration in dealing with this class of injury.

The later method, which has been brought into such prominence by Mr. Arbuthnot Lane, is the one which to-day is receiving the greatest amount of attention.

It consists in the use of long, steel screws, four to six in number, according to circumstances, fastening a strong steel plate which holds the bones rigidly in accurate position one with the other, and which is allowed to remain in the wound after it has been closed, thereby assuring absolute sup-

port to the broken ends during the process of repair. In many cases, the plate may be worn by the patient indefinitely, without causing any discomfort or inconvenience, but if irritation should arise from this, it is open to the objection that it must be removed by a second, though trifling, operation.

The essential feature of all these methods mentioned is the perfect and accurate reduction of the displacement by extension in some form, which is often very difficult, particularly if it is an old injury where attempt at repair has already been made.

To facilitate this, the method devised by Dr. Martin of making extension directly on the upper end of the lower fragment in the wound and drawing it down by extension weights or pulleys, is one of the very best means at our command of correcting the deformity, so far as the actual extension is concerned.

The writer is disposed to regard this method as preferable to the extension of the leg by the use of pulleys, etc., as before recommended in another communication.

Dr. Martin has devised an ingenious pair of clamps which, after the ends of the bones have been accurately adjusted, facilitates the application of the plate and the introduction of the screws. I think this can again be very much modified by the use of curved retractors. This enables the operator to free the bone from any old adhesions, particularly on the opposite side of the wound, and then hold it accurately in position after the readjustment and while the plate is being applied. These retractors, by their simplicity, are preferable to many of the heavy forceps and clamps which have been devised.

The greatest care must be exercised to see that the drill and the screws accurately correspond to each other in size and length, so that the screws will have accurate bearing along their entire course. Care must also be taken to see that the screws are not so long as to perforate the opposite side of the bone, and it is advisable always to have a number of screws of different lengths, corresponding to the size of the bone to be dealt with.

Before dismissing this subject, the site of the incision is worthy of consideration. The wound, which must necessarily be large, is preferably made on the outer side of the quadratus femoris muscle on the anterior surface of the thigh, rather than on the outer side of the leg between the line of the flexor and extensor groups of muscles. The latter incision has the advantage, however, of allowing the more perfect drainage, but the anterior wound can be readily drained by making a counteropening directly down through the muscles, through which a small wick of gauze can be introduced and retained for forty-eight hours, which insures rapid removal of all serum which necessarily collects after so large a wound, thus minimizing the possible risks of infection.

It is important also that, in closure of the wound, all dead spaces should be obliterated as much as possible by the introduction of deep buried catgut sutures.

Mr. Lane lays great stress upon using instruments with as long handles as possible, so as to obviate introducing into the wound even the gloved hand, thus minimizing possible risk of infection.

When the patient is placed in bed, the limb should be thoroughly supported by long lateral supports, either splints or a plaster case, to insure absolute rest of the parts. If this method of treatment is carried out, it will be found that the limb will correspond accurately in measurements to the sound limb, both with regard to length and position. All muscular spasm disappears, as we have no irregular or ragged ends of the bones to cause irritation to the soft parts.

In concluding these remarks, the writer does not wish to advocate the open method of treatment in all cases of fractures of the shaft of the femur, but only in those cases where it is impossible to get reasonably accurate approximation of the bones, as can be readily shown by the use of the X-ray photograph.

This method is not applicable to very young children nor to old or enfeebled persons, but only to those who are in good health and whose habits of life would naturally tend toward a favorable result.

The greatest care must be exercised, not only as to the method of technic employed, but in determining whether or not one's patient will co-operate with every effort of the surgeon to bring about a perfect result.

Too great emphasis, then, cannot be laid upon the importance of dealing with these cases as soon as possible after it has been demonstrated by the X-ray that the ends of the bones are not in accurate position, because the difficulty of the operation is greatly enhanced by allowing these cases to remain for several weeks before operating, in the hope that, by weight and extension, the bones will be brought into better position. The many adhesions and new callus resulting from this delay all add untold difficulties in attempting to bring the ends of the bones into position.

Finally, may I be permitted to offer a word or two of advice to those who may desire to practise some of the suggestions which I have made and who are without any practical experience in this line of work?

1. Find out all that is possible about the seat of fracture by the use of carefully prepared X-ray plates, the pictures to be taken at various angles.

2. Consider carefully what method you think is likely to give the best results.

3. When the fragments are exposed, have a proper pair of calipers to determine the diameter of the bone, and see that the screws in no case penetrate the opposite side.

4. Be certain that you have suitable instruments, proper drills and screws, and also competent assistants, so that you can complete the operation quickly and with as little destruction to the soft parts as possible.

5. Be sure before closing your wound, that it is thoroughly dry and that all dead spaces are obliterated, so that there will be no possible chance for the development of a small hæmatoma, which is so conducive to later infection.

6. Remember in dealing with this class of surgery, that the parts are hard and unyielding, and everything must fit accurately and securely. Nothing can be drawn or pulled

into position, as in dealing with the soft parts. Do not trust too much to nature with the hope that she will correct defects in your joiner work.

7. If possible, try and practise this operation on the cadaver before trying it on the living.

NOTE.—In reviewing a certain number of cases treated after the method above described, the author finds that care must be exercised not to allow the patient to bear his weight upon a limb which is apparently in good shape, as the repair of these injuries requires much longer time than simple fractures, and the callus, though apparently strong, is in many instances soft and yielding; if the patient is allowed to walk too soon, lateral deformity will occur, due simply to the outward bowing of the limb, as the result of superinduced weight of the body.

In this case, it will be noticed frequently that the screws have drawn away from their attachment in the shaft of the bone, and the plate will be forced off at an angle corresponding to the bowing of the limb. Too great care cannot be taken to supplement the use of the plates by suitably applied splints and extension, which should be maintained all through the process of convalescence, thus obviating the tendency to displacement.

FRACTURE OF THE PATELLA.*

WITH A REPORT OF FIFTY-SIX CASES.

By EMORY G. ALEXANDER, M.D.,

OF PHILADELPHIA,

Demonstrator of Fracture Dressings, Jefferson Medical College and Women's Medical College; Assistant Surgeon, Kensington Hospital for Women; Surgeon to Out-Patient Department, Episcopal Hospital, and Children's Hospital, Mary J. Drexel Home.

THIS paper comprises a study of 56 cases of fracture of the patella, admitted to the Episcopal Hospital since the year 1905.

To Drs. Neilson, Deaver, Davis, and Frazier, to whose services these patients were admitted, I am indebted for the privilege of reporting these cases. To Dr. H. C. Deaver I am especially indebted for the privilege of operating upon several of these cases, and to his wise counsel, especially in suggestions of operative technic and after-treatment, do I owe much of the success gained.

The primary object of this paper is to discuss the operative technic and after-treatment, therefore little shall be said of the causes, varieties, diagnosis, and symptoms of this very important and interesting fracture.

Of the 56 cases tabulated, 37 were in males, while 19 occurred in females, a ratio of almost two to one. There is no anatomical explanation for the more frequent occurrence of this fracture among males, and, in all probability, it is due to their greater exposure and activity.

The ages in this series range from 18, the youngest, to 77, the oldest. I have arbitrarily classified them according to age as follows:

Four occurred between the ages of 10 and 20; 11 between 21 and 30; 19 between 31 and 40; 14 between 41 and 50; 6 between 51 and 60; 1 between 61 and 70, and 1 between 71 and 80.

* Read before the Philadelphia Academy of Surgery, December 5, 1910.

The greatest frequency occurred between the ages of 31 and 40 years; the period, certainly, of the greatest business activity. It is rather unusual for this fracture to occur under 20 years of age. This is probably due to the bony condition or better muscular control of the young, they being less apt to slip or fall. The youngest patient that I have any personal knowledge of was a boy aged 12 years. This case was operated upon with excellent result, by Dr. H. C. Deaver, at the Children's Hospital of the Mary J. Drexel Home.

Of the 37 males, 19 broke their left patella, while 18 broke the right. Of the females, 11 broke the left, and 8 the right patella.

It appears from this, although the numbers are almost equal, the ratio being larger in the females, that the left patella is more apt to be fractured. Anatomists claim that no asymmetry exists in the lower extremity. Is this fracture purely an accident or is there some cause for its more frequent occurrence in the left patella? Some greater muscular development, a longer step with one leg, or a firmer tread with one foot should be thought of.

The causes given in this series were: "fell," 27; "slipped," 27; "kicked," 2. The histories were somewhat indefinite on this point and I could find only 9 that actually fell from a distance, so whether the "fell" meant a slip and a fall, or a fall from a distance, I cannot say. I am inclined, however, to think the former the case. Several of the patients stated that they slipped, heard something break, and fell.

A great majority of these fractures were of the usual transverse variety, with the large fragment above. A few of this transverse variety showed the reverse to be true, the large fragment being below. Forty-nine cases were of this combined transverse type. Six cases were comminuted; these occurred in two that were kicked, and in four that fell from a distance. The number of fragments in this latter type varied from three to many. No compound fracture occurred in this series.

I have taken a picture of a normal patella in three positions: with leg extended, semiflexed, and acutely flexed. The

patella with the leg semiflexed is seen at the highest point of the condyle of the femur, and it is with the leg in this position that the fracture usually occurs. A sudden strain on the leg, with a violent contracture of the quadriceps extensor muscle, snaps the patella at its weakest and most unsupported point, the lower third.

The symptoms and diagnosis I shall omit, as there is nothing I can add to that already known of the former, and the latter is usually quite easy.

Little shall be said of the non-operative treatment, as all agree that by this method nothing but fibrous union can be hoped for, with more or less separation of the fragments. Certainly in the great majority of instances the results are far inferior to those of the open method of treatment. There are, of course, certain cases that must be treated by this method, as the aged, those in whom some constitutional condition contraindicates operation, or those, who although good operative risks, refuse to be operated upon. Comminuted fractures, with no separation or tilting of the fragments, and, in all probability, no tear in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule, may also be treated by the conservative non-operative method. Of the many conservative methods of treating this fracture, that employed by the late Dr. Agnew is probably as good as any.

I am fully aware that many think the open method of treatment a dangerous one and one that should be done only by a skilled operator. They are willing to operate themselves, but unwilling to teach it. It is dangerous for an occasional operator and one unfamiliar with asepsis and operative technic to do any major operation. I believe that the open method should be taught, but, at the same time, the physician and occasional operator should be alive to the fact that an operation for fracture of the patella is not a minor one, involving, as it does, the largest and at the same time one of the weakest joints in the body, and that if infection does occur, it may end most disastrously. Consequently it is an operation accompanied with a certain definite risk, and one probably attended by much more danger than a simple appendectomy, as the

synovial membrane does not seem to possess the protective power of the peritoneum in taking care of a slight infection.

The best time to operate is now thought to be after all oozing has ceased, after the exudate has reached its height and has even begun to subside, and the tissues have had time to become sealed off. This process usually takes from six to ten days, but it can be hastened somewhat by placing the leg on a posterior splint, with elevation, and the application of an ice bag. In reviewing the histories of these cases, the temperature charts, as a whole, failed to show any marked difference between those operated upon early and those in whom the operation was delayed. The immediate success of these cases depends entirely on whether or not infection occurs. This, I believe, rests between the resistance of the tissues, the virulence of the infection, if one does occur, the preparation of the patient, and the operative technic. Dr. Murphy has pointed out that in an early operation the surgeon is working in tissues somewhat devitalized and, therefore, less resisting and more apt to become infected.

In a letter, which I quote with his permission, Dr. Murphy says: "My reason for postponing the operation for six to ten days is to give the synovial membrane an opportunity to react to the irritation of the trauma and the irritation of the blood-clot in the joint. This reaction produces a cofferdamming of the lymph spaces in the subendothelial layer of the synovial membrane, and lessens the danger of infection very materially."

"We resorted to an injection of 10 c.c. of formalin and glycerine into the joint, immediately after the fracture. This produces a chemical irritation, increases the number of polymorphonuclear leucocytes in the joint, and increases the constitutional polymorphonuclear reaction. It also cofferdams the lymph spaces and insures a prophylaxis against infection. The operation is then done five to seven days after this injection."

Theoretically, with perfect technic, there is nothing to gain by delay other than to allow the oozing, especially from the torn synovial membrane, to cease, as this in an early operation can be quite annoying. Practically, however, we know that

our technic is not always perfect and that infection does sometimes occur. This is lessened by a late operation and, likewise, I believe, the patient suffers much less the first few days after the operation, and the convalescence is shortened, as there is less local reaction.

The incision should be elliptical. It makes little difference if the convexity is above or below. Some surgeons claim the convexity should be above, as it takes the scar away from the knee and is less apt to cause pain with the patient in the kneeling posture. Of the cases I was able to follow, I was unable to substantiate this claim. I think the incision should be an elliptical one, preferably below, as a greater exposure can be obtained well away from the line of fracture, and it lessens the chance of infection and after-complications, especially if silver wire is used. The incision should be carried well down on either side, as I shall point out later, to permit drainage. The next step in the operation, after reflexing well the skin flap, is to divide the prepatellar bursa and fascia lata. The clots are now swabbed out with dry gauze, no fluid being used, and if any irrigation is necessary, only saline solution or sterile water should be employed, as bichloride or other devitalizing or irritating agents are apt to increase the flow of serum and favor infection. The reflected tendon over the broken edges is now retracted, the frayed ends rounded, and by blunt dissection separated a short distance from the margin of the fracture. Often this is impossible on account of the small fragment. The raw surface of the patella should next be freshened, especially in late operations, to get rid of the adherent organizing clot. With a hand drill, beginning in the centre of the upper fragment about one centimetre from the margin of the fracture, a hole is drilled obliquely downward so as to emerge on the broken surface just at the point where the dense cancellous tissue and thin compact lamina unite. A similar opening is drilled in the lower fragment. Through these two holes a silver wire is passed, the fragments are brought together as accurately as possible, and the wires twisted one or two times; the redundant wire is cut off, and the twisted ends that remain are reflected upwards under the

tendon and gently hammered down. Some operators use two wire sutures, one being placed on either side of the patella. The tendon is next sutured with chromic gut, and likewise the torn fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule. At the lower angle of the wound, if the rent in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule does not extend so far down, an opening should be made to permit drainage. The prepatellar bursa and fascia lata are next sutured with chromic gut and the skin by interrupted silkworm gut sutures. The skin wound should not be sewed too tight, neither should too many stitches be applied. The angles of the wound corresponding to the openings in the fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule should be left open. As a rule, this procures sufficient drainage, but if there has been much oozing, a few strands of silkworm gut or a small piece of rubber tissue can be inserted. The leg is now placed on a well-padded, slightly convex, posterior splint until the patient has fully recovered from the effects of the anæsthetic, when the splint is removed and the leg is placed on a pillow.

The point that I wish to emphasize in the operative technic is the advantage of silver wire. Out of the thirty cases that I have been able to follow, four refractured the patella; three of these were sutured with absorbable material. The one that refractured with wire was due to a fall downstairs, and so great was the strain thrown upon the patella, that the wire cut through the upper fragment. Silver wire is certainly the most aseptic and at the same time the strongest suture material that can be used. The only disadvantage is that it occasionally has to be removed. Removal was necessary in three cases in this series. This undoubtedly can be avoided, provided no infection occurs, but even if skin infection—the most common in this operation—does occur, if the skin incision is well away from the line of fracture, and if the ends of the wire are not left too long and are well covered by the tendon, fascia lata, and prepatellar bursa, removal of the wire may not be necessary. If the wire has to be removed, however, it can be easily done with little inconvenience to the patient. That wire causes

softening of the bone around the opening is highly improbable unless some infection occurs. Wire is certainly no more irritating than any other material used in these cases, as kangaroo tendon, chromic gut, or even, as has been used, silkworm gut.

Cotton, in his excellent book on "Dislocations and Joint Fractures," states that refracture after the eighth week is rare. Only one of this series occurred in that time; the others ranging from four months to four years.

Is bony union obtained in a fracture of the patella? Some surgeons claim not. Personally, I have never examined a sutured fractured patella under the microscope and cannot say. In one of these cases I removed a wire one year after operation. I took the opportunity, clinically, to examine the union and to all appearances it was bony. In this case, even though there had been a slight skin infection followed by a persistent sinus for several months, the bone did not appear soft around the wire, and it took quite a "tug" to dislodge it. As shown by the refractures occurring in this series, the bony union, if one is obtained, is not strong. Why then not reinforce this with a non-absorbable suture?

The after-treatment of these cases is most important. The splint is removed as soon as the patient has recovered from the effects of the anæsthetic, or, preferably, it can be left on through the first restless night following the operation. On its removal, the leg, slightly flexed, is placed on a pillow. Gentle passive motion is begun in a day or so. As it is possible to move the leg through an angle of five or ten degrees without moving the patella, this much motion is taken advantage of. The passive motion is gradually increased so that by the third week the leg can be flexed to a right angle. In the last case that I operated upon, the patient could flex the leg to a right angle on the tenth day, was allowed out of bed on the twelfth, and walked the next day. He was discharged, walking, from the hospital on the sixteenth day. It is a mistake to keep the leg for weeks on a splint or in a cast. Not only does the patient lose much time by the delay, but the muscles become atrophied and the knee more or less ankylosed. These patients will tell you that they were a year getting a

useful limb. Of the ultimate end results, say one year after operation, there is little to choose between. All that I was able to follow got a fairly good functioning result. Some complained of a little stiffness or weakness in the knee on flexion or extension. A few complained of pain in the knee before a storm. On the whole, all showed excellent results; especially was this true of the five private cases operated upon by Dr. Deaver. These patients were treated by the above method, and so excellent were the results, that one would never know, except on close examination, that they had a fracture of the patella. The others, in all probability, would have had as good a result if they could have been properly carried through the late after-treatment.

In this series, two cases died, both from sepsis. One was operated upon on the fourth day, the other on the thirty-fifth day following the accident. The first, a woman, had an abortion ten days before the accident, and when operated upon, unknown to the surgeon, had a bad discharge from her uterus. Whether this patient died from a primary infection or one occurring through her blood, it is hard to say. Her knee did not show much inflammatory change for several days after the operation, although she was profoundly septic. Repeated blood cultures were negative. A culture taken from the knee, however, showed a bacillus morphologically resembling the Klebs-Löffler. Everything possible was done to save this patient's life. Her leg was amputated three and one-half months after the primary operation, but she died two weeks later of exhaustion. The other death occurred in a man who was operated upon five weeks after the accident. I saw the operation performed and the technic was apparently faultless, but evidently some error occurred, for the knee became infected, and the patient died two months later of sepsis.

The majority of cases operated upon showed a febrile reaction ranging from 99° to 102° a day or so after the operation, but the fever usually subsided by the fourth to the sixth day.

In those cases badly infected following the operation, the best chance of saving the patient's life is by early laying open the joint and packing with iodoform gauze.

Some surgeons claim that in comminuted fractures a conservative method of treatment should be used. This rule, as all others, has its exceptions. In one fracture that I operated upon, due to a kick, the patient fell after the blow and evidently tore the fibrous expansion of the quadriceps tendon. In another case, due to a fall from a distance, there was little tear of the fibrous expansion of the quadriceps tendon, but the fragments were tilted and separated by the effusion and clot. These two classes of cases should certainly be operated upon; in the first instance to repair the torn fibrous expansion of the quadriceps tendon, fascia lata, and joint capsule, and in the second, to adjust the fragments and to turn out the clot. In comminuted fractures, especially if broken in many pieces, suturing the bone is often impossible, and the best that can be done is to suture the tendon and carry the patient through a prolonged convalescence.

In the letter referred to above, Dr. Murphy also says: "In cases where the patella is badly fragmented, we believe the use of a flap three-fourths of an inch wide and four and one-half inches long, from the central portion of the quadriceps tendon, passed over the patella and inserted into the ligamentum patellæ by splitting it and looping it half way around, is the most secure means of holding the patella. It does not then involve the traumas in the joint nor the presence of foreign material, such as wire or plates. It is one of the simplest means of treating these fractures, and I believe one of the most secure, following out the plan I do in my cases of resection of the patella for tuberculosis."

In fracture of the patella, if bony union does occur, close approximation of the fragments is essential. This close approximation cannot always be gained by simply suturing the tendon and not the patella, as effusion or movement may dislodge the fragments. In suturing with an absorbable material, a close approximation is possible, but often these sutures soften, elongate, become untied or even break; especially is this so, if close approximation is not obtained and the fragments move independently of each other. In using absorbable material, passive motion must be delayed and the patient is

compelled to pass through a slow convalescence, followed by a more or less stiffness of the joint that usually lasts for several months, to say nothing of the loss of time which many of them can ill afford.

Total number of fractures of the patella.....	56
Males	37
Females	19
Males fracturing right patella	18
Males fracturing left patella.....	19
Females fracturing right patella.....	8
Females fracturing left patella.....	11
Variety: transverse fracture	50
Comminuted fracture	6
Suture: silkworm gut	1
Chromic gut	15
Kangaroo tendon	2
Silver wire	31
After treatment: plaster case	15
Splint	8
Splint and case	9
Pillow	17
Splint (not operated).....	7
Causes: slipped	27
Fell	27
Kicked	2
Tendon alone sutured.....	3
Refractures: absorbable suture.....	3
wire suture	1
Operated upon	49
Not operated upon.....	7

REPORT OF CASES.

E. W., age 42; female. Transverse fracture of patella of left knee; caused by slip. Operation 6 days later; silkworm gut suture; cast. In hospital 57 days. Highest temperature 99.3. Recovered.

S. B., age 20; male. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; chromic gut suture; cast. In hospital 27 days. Highest temperature 100.3. Recovered.

S. B., age 27; female. Transverse fracture of patella of right knee; caused by slip. Operation 2 days later; wire suture; splint and cast. In hospital 45 days. Highest temperature 99.4. Recovered.

P. N., age 43; male. Comminuted fracture of patella of right knee; caused by fall. Not operated; splint. In hospital 50 days. Recovered.

J. S., age 48; male. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; chromic gut suture; splint and cast. In hospital 33 days. Highest temperature 101.2. Recovered.

A. F., age 38; male. Transverse fracture of patella of left knee;

caused by slip. Operation 2 days later; chromic gut suture; cast. In hospital 85 days. Highest temperature 100.1. Recovered.

A. S., age 55; female. Transverse fracture of patella of right knee; caused by slip. Operation 20 days later; wire suture; splint. In hospital 50 days. Highest temperature 100.1. Recovered.

A. N., age 67; female. Comminuted fracture of patella of right knee; caused by slip. Not operated; splint. In hospital 35 days. Recovered.

J. B., age 27; male. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; kangaroo tendon suture; splint and cast. In hospital 14 days. Highest temperature 100. Recovered.

H. W., age 40; male. Comminuted fracture of patella of right knee; caused by kick. Not operated; splint. In hospital 30 days. Recovered.

H. B., age 38; female. Transverse fracture of patella of left knee; caused by fall. Operation 3 days later; chromic gut suture; cast. In hospital 25 days. Highest temperature 100.1. Recovered.

W. W., age 44; male. Comminuted fracture of patella of left knee; caused by fall. Operation 1 day later; chromic gut suture; cast. In hospital 31 days. Highest temperature 100. Recovered.

G. O., age 37; male. Transverse fracture of patella of left knee; caused by slip. Operation 14 days later; chromic gut suture; splint. In hospital 35 days. Highest temperature 102. Recovered.

A. S., age 54; female. Transverse fracture of patella of left knee; caused by fall. Not operated; splint.

H. B., age 38; female. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 28 days. Highest temperature 100.1. Recovered.

H. R., age 30; male. Transverse fracture of patella of left knee; caused by slip. Not operated; splint.

W. W., age 44; male. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 32 days. Highest temperature 99.1. Recovered.

J. B., age 27; male. Transverse fracture of patella of left knee; caused by fall. Operation 3 days later; kangaroo tendon suture; cast. In hospital 34 days. Highest temperature 100.2. Recovered.

F. S., age 28; female. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 25 days. Highest temperature 100. Recovered.

R. G., age 32; male. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; wire suture; splint. In hospital 35 days. Highest temperature 100.1. Recovered.

M. H., age 77; female. Transverse fracture of patella of left knee; caused by fall. Not operated; splint.

E. G., age 50; male. Transverse fracture of patella of right knee; caused by fall. Operation 4 days later; chromic gut suture; cast. In hospital 26 days. Highest temperature 100.2. Recovered.

F. H., age 36; male. Transverse fracture of patella of left knee; caused by slip. Not operated; splint.

L. B., age 60; male. Transverse fracture of patella of right knee; caused by fall. Operation 18 days later; wire suture; pillow. In hospital 45 days. Highest temperature 100.1. Recovered.

W. K., age 44; male. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; splint. In hospital 35 days. Highest temperature 100.2. Recovered.

E. S., age 27; female. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 16 days. Highest temperature 99.4. Recovered.

W. H., age 40; male. Comminuted fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; splint and cast. In hospital 29 days. Highest temperature 100.1. Recovered.

E. S., age 45; female. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; wire suture; splint and cast. In hospital 46 days. Highest temperature 100. Recovered.

J. S., age 37; male. Transverse fracture of patella of left knee; caused by fall. Operation 4 days later; wire suture; cast. In hospital 25 days. Highest temperature 100.2. Recovered.

C. D., age 31; female. Transverse fracture of patella of left knee; caused by slip. Operation 2 days later; chromic gut suture; cast. In hospital 41 days. Highest temperature 100.1. Recovered.

W. M., age 40; male. Transverse fracture of patella of left knee; caused by slip. Operation 1 day later; wire suture; cast. In hospital 13 days. Highest temperature 99.4. Recovered.

N. R., age 35; male. Transverse fracture of patella of right knee; caused by fall. Operation 1 day later; wire suture; pillow. In hospital 17 days. Highest temperature 100.1. Recovered.

N. R., age 35; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; pillow. In hospital 12 days. Highest temperature 99.3. Recovered.

E. W., age 34; female. Transverse fracture of patella of right knee; caused by slip. Operation 1 day later; wire suture; cast. In hospital 33 days. Highest temperature 101. Recovered.

J. F., age 42; male. Transverse fracture of patella of right knee; caused by fall. Operation 3 days later; chromic gut suture; splint and cast. In hospital 32 days. Highest temperature 99.4. Recovered.

C. M., age 30; male. Transverse fracture of patella of right knee; caused by slip. Operation 6 days later; chromic gut suture; splint. In hospital 41 days. Highest temperature 101. Recovered.

W. L., age 18; male. Transverse fracture of patella of right knee; caused by slip. Operation 17 days later; wire suture; pillow. In hospital 25 days. Highest temperature 99.3. Recovered.

E. K., age 55; male. Transverse fracture of patella of right knee; caused by slip. Operation 35 days later; wire suture; splint. In hospital 67 days. Highest temperature 105. Died.

J. F., age 53; male. Transverse fracture of patella of left knee; caused by fall. Operation 7 days later; wire suture; pillow. In hospital 27 days. Highest temperature 99.4. Recovered.

J. W., age 55; male. Transverse fracture of patella of right knee;

caused by slip. Operation 12 days later; wire suture; pillow. In hospital 35 days. Highest temperature 100.1. Recovered.

F. T., age 35; female. Transverse fracture of patella of right knee; caused by fall. Operation 4 days later; wire suture; pillow. In hospital 115 days. Highest temperature 105.3. Died.

J. R., age 19; male. Comminuted fracture of patella of left knee; caused by kick. Operation 4 days later; wire suture; pillow. In hospital 36 days. Highest temperature 100.4. Recovered.

A. T., age 45; male. Transverse fracture of patella of right knee; caused by slip. Operation 5 days later; wire suture; splint and cast. In hospital 28 days. Highest temperature 100.3. Recovered.

A. D., age 40; female. Transverse fracture of patella of right knee; caused by slip. Operation 5 days later; chromic gut suture; splint. In hospital 45 days. Highest temperature 100.2. Recovered.

J. O., age 33; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; chromic gut suture; cast. In hospital 22 days. Highest temperature 99.4. Recovered.

F. M., age 30; female. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 44 days. Highest temperature 100.3. Recovered.

E. W., age 49; male. Transverse fracture of patella of right knee; caused by slip. Operation 8 days later; wire suture; pillow. In hospital 30 days. Highest temperature 100.4. Recovered.

J. S., age 37; male. Transverse fracture of patella of left knee; caused by fall. Operation 6 days later; chromic gut suture; splint. In hospital 29 days. Highest temperature 100.1. Recovered.

T. G., age 22; male. Transverse fracture of patella of left knee; caused by slip. Operation 4 days later; wire suture; pillow. In hospital 30 days. Highest temperature 101.4. Recovered.

F. H., age 20; female. Transverse fracture of patella of right knee; caused by fall. Operation 9 days later; wire suture; cast. In hospital 38 days. Highest temperature 100. Recovered.

L. W., age 28; female. Transverse fracture of patella of left knee; caused by slip. Operation 1 day later; wire suture; pillow. In hospital 34 days. Highest temperature 100.1. Recovered.

G. E., age 41; male. Transverse fracture of patella of left knee; caused by fall. Operation 5 days later; chromic gut suture; cast. In hospital 42 days. Highest temperature 101. Recovered.

M. A., age 39; female. Transverse fracture of patella of left knee; caused by slip. Operation 5 days later; chromic gut suture; cast. In hospital 61 days. Highest temperature 100.4. Recovered.

D. M., age 44; male. Transverse fracture of patella of left knee; caused by slip. Operation 8 days later; wire suture; pillow. In hospital 25 days. Highest temperature 99.4. Recovered.

W. M., age 28; male. Transverse fracture of patella of right knee; caused by fall. Operation 2 days later; wire suture; splint and cast. Highest temperature 101.3. Recovered.

G. H., age 42; male. Transverse fracture of patella of left knee; caused by slip. Operation 9 days later; wire suture; splint and cast. Highest temperature 98.3. Recovered.

NEPHROURETERECTOMY.

DESCRIPTION OF A SIMPLE AND IMPROVED METHOD.

BY HOWARD LILIENTHAL, M.D.,

OF NEW YORK,

Surgeon to the Mount Sinai and Bellevue Hospitals.

THE attitude of most surgeons regarding the disposition of the divided ureter after nephrectomy seems to indicate a strange unwillingness to complete the operation in a scientific and radical manner. Even when serious infection is present, most operators show a singular trustfulness when the question arises of removing the entire ureteral tube along with the diseased kidney.

In the various society discussions, it is common to note that the usual method of performing nephrectomy includes merely ligation and disinfection of the ureteral stump. One says: "The ureter seldom gives rise to any trouble, even when diseased." Another: "The ureteral stump should be followed down as far as possible (?), then ligated and disinfected." Still a third: "When infected, the ureter should be sutured into the wound," etc. Rarely we see patients presented in whom a total ureterectomy through a gigantic incision has been performed to remove a thickened and inflamed tube, the size of a piece of small intestine.

To quote at random from the literature, Ransohoff, in Keene's "Surgery," vol. iv, p. 259, under "Nephrectomy," says: "Where the isolation of the ureter is possible it may be left to take care of itself after being tied, provided there is no infection. In pus cases, and particularly in tuberculosis, as much of the ureter should be removed as possible; or, if this is not feasible, its proximal end should be fixed in the lower part of the wound by a suture."

On page 260: "When the seat or nature of the ureteral lesion is unknown, the exposure of the duct is best made by

the retroperitoneal operation, which permits an examination of its entire length. A long lumbo-iliac incision is made, beginning below the last rib, as in the operation for exposing the kidney. In a gentle curve it is directed downward and forward an inch within the anterior superior process, and thence continued forward a little above Poupart's ligament, and parallel to it quite to the border of the rectus. The dissection necessary to expose the ureter is but an extension downward of that for the kidney."

Morris, in "Surgical Diseases of the Kidney and Ureter," 1904, vol. ii, page 242, says: "If the ureter is thickened or diseased, it should be left until after the vessels of the pedicle have been ligated and divided, and then it should be followed down as far as the brim of the true pelvis or lower and there ligated with a medium-sized silk ligature and divided between the ligature and forceps."

Bickham, in "Operative Surgery," page 858, says: "If healthy, the proximal end of the ureter should be cauterized and dropped back into the wound; if unhealthy it should be attached into the wound and drained."

We note throughout a disinclination to prolong the operation in order to remove the ureter, and that in cases in which the duct has been extirpated, it has almost invariably been done at a subsequent operation through an incision beginning at the nephrectomy wound and extending downward and forward to or beyond the edge of the rectus near its pubic insertion.

Of the necessity for removal of the diseased ureter, especially in cases of tuberculosis, I am fully convinced. Repeatedly I have seen lumbar sinuses and abscesses, as well as retrovesical suppuration, following the incomplete extirpation of a tuberculous ureter. I have also encountered cases of tuberculous cystitis with the characteristic dysuria and hæmaturia and with tubercle bacilli in the urine, in which nothing but a short stump of diseased ureter had been left following nephrectomy, the other kidney being comparatively healthy. The cystoscopic picture in these cases

FIG. 1.



Showing nephrectomy wound; urethral bougie tied in the ureter.

FIG. 2.



Showing inguinal incision, with ureter and its contained bougie drawn out of the wound.

FIG. 3.



The bougie has been withdrawn and the ureter extracted at the inguinal wound. It still remains attached at the bladder, and the index finger is loosening the lower portion previous to ligation and removal.

is the same as that of tuberculous nephritis—in other words, the same as it was before the operation. I am convinced that if the removal of the diseased ureter could be made easy and rapid, total ureterectomy would be the routine procedure.

In a number of cases I have removed the ureter down to the bladder itself by a method so simple and attractive that I am sure it will at once recommend itself to the profession. It means the prolongation of the total time of operation from five to ten minutes, or, if the patient is in a truly critical condition and adhesions look formidable, the ureterectomy may be postponed.

The steps of the operation are as follows: Extraperitoneal nephrectomy by any of the approved methods. The ureter and vessels being tied separately, the ureter should be cut between two ligatures or forceps and the mucous membrane of the stump cauterized with 95 per cent. phenol. The ureter is now drawn out of the wound if possible, or it is isolated by gauze, and the forceps or ligature having been removed, a good sized flexible *urethral* bougie with conical or olive point is passed down toward the bladder. A ligature is tied tightly around the ureter and instrument, so as to hold the bougie in place and prevent the leakage of infected fluids from the canal. The greater part of the lumbar wound may now be closed with drainage in the usual manner, and the patient is turned on his back. An oblique incision of from $1\frac{1}{2}$ to 3 inches in length, according to the adiposity of the individual or the thickness of his abdominal wall, is made about an inch to the median side of the anterior superior iliac spine. This is carried rapidly through the abdominal muscles to the peritoneum, and then the gloved finger can easily work its way extraperitoneally down to the ureter, which will be invariably and instantly recognized because of the characteristic feel of the instrument within its lumen. A thickened and indurated ureter may be identified even without the bougie. It must be remembered, of course, that the ureter is lifted up with the peritoneum. The finger will now find no difficulty

in separating the ureter and drawing it with its contained bougie out of the wound, when an assistant withdraws the instrument from the nephrectomy wound and tightens the ligature. A gentle pull will draw the upper portion of the ureter out of the inguinal wound, and it may then be easily followed down to the bladder where it must be firmly ligated and cut off, the mucosa being disinfected with phenol. If desired the latter part of the operation may be performed under the guidance of the eye by elevating the foot of the table and exposing the depths with retractors. In ordinary cases the entire procedure takes but little longer than its description. The wound may now be closed by layer suture with a very small 48-hour drain down to the bladder. Should there be infection, which may well occur when the walls of the ureter have been seriously changed by disease, great attention must be paid to the method of drainage. A rubber tube lying for a long time in this region may cause ulceration of the great iliac vessels, with sudden and fatal hemorrhage. Soft tubing, gauze, or rubber dam will here prove serviceable.

NOTE.—Patients illustrating the results of this operation were presented at the November, 1910, meeting of the Section on Surgery of the New York Academy of Medicine, and also at a meeting of the New York Surgical Society held January 11, 1911, at Mount Sinai Hospital.

TECHNIC OF THE OPERATIVE TREATMENT OF APPENDICITIS.*

WITH ESPECIAL REFERENCE TO THE TREATMENT OF PERITONITIS.

BY ALEXANDER B. JOHNSON, M.D.,

OF NEW YORK,

Surgeon to the New York Hospital.

IN the surgical service of the New York Hospital a large number of patients are operated upon for appendicitis every year. At the present time a technic is in use which is practically uniform among the several surgeons, though varying slightly in minor details. The results are good. A mortality in acute cases usually lower than 5 per cent. is obtained, and it has several times happened that a surgeon has operated upon 100 acute cases without a death. The type of appendicitis seen this autumn in New York has been particularly severe, gangrenous cases have been very frequent, with the result of a slightly higher mortality.

Time of Operating.—All acute cases are operated upon at once, at any hour of the night or day as soon as they can be prepared by shaving and an enema. The iodine treatment of the skin is sometimes used; in most cases other methods of cleansing; soap and water, alcohol and ether followed by alcoholic bichloride solution, 1:1000; in a few the skin is slightly rubbed with benzine instead of with alcohol and ether, in others with turpentine.

By acute cases I mean those characterized by a sudden onset of abdominal pain usually followed by vomiting, and by tenderness over the appendical region followed by rigidity more or less marked over the right lower quadrant of the belly. A more or less marked leucocytosis with a relative increase of polymorphonuclear cells is regarded as a sign of great value. A rise of temperature and an accelerated pulse-rate are usually present. Personally, I believe that tender-

* Read before the New York Surgical Society, January 25, 1911.

ness and rigidity in the appendical region, following a sudden attack of general or umbilical pain and vomiting, justify operation, *a fortiori* when with moderate leucocytosis the percentage of polynuclears is high.

In the cases of retrocæcal abscess rigidity is often absent, since the parietal peritoneum of the anterior abdominal wall is not inflamed, in these we depend upon deep tenderness, the detection of a mass, and a characteristic leucocytic count. In deciding for or against immediate operation in cases of doubt, I believe fewer risks are run by operating than by delay.

In the cases of sudden perforation with intense septicæmia we operate as soon as we can, whether late or early.

The Ochsner treatment has not found favor among the surgeons of the New York Hospital.

Incisions.—In nearly all cases, with exceptions to be mentioned, whether acute, chronic, or interval, the McBurney intermuscular incision is used. The cut is made parallel with the fibres of the external oblique, its centre opposite to the spine of the ilium and distant therefrom about two inches. The cut is from two to three inches in length, the muscular layers are separated in the usual manner, and the peritoneum opened in a direction at right angles to the cut in the skin. Before opening the peritoneum all bleeding points are tied. The subsequent procedures vary according to the character of the case.

In cases evidently not complicated by extra-appendicular infection the cæcum is sought for and drawn out of the wound by grasping its wall with a piece of gauze. If the appendix does not at once appear, the anterior white muscular bundle is followed downward, the appendix felt for with the index finger, breaking up such adhesions as exist to bind it down, and delivered.

In pus cases where few or trifling adhesions are present the same method is pursued. Intra-abdominal pads are not used to prevent the spread of infection. Their use is confined to the cases in which omentum or small intestine persists in presenting in the wound, in order to keep these structures out of the way.

In case of a walled-off abscess of several days' duration the abscess is opened and its contents are permitted to escape or are aspirated after the manner to be mentioned later. Diligent search is then made for the appendix with the finger, aided by the eye and good retraction. If the duration of the abscess has been long, and its walls are found dense and firm, and if the appearance of the exudate and of the abscess wall indicates that the appendix exists only as a slough, search for the remains of the appendix is sometimes given up. Such an event is rare, and only occurs when a further search would involve excessive trauma.

The appendix having been delivered together with enough of the cæcum to render the base of the appendix accessible, all instruments, retractors, etc., are removed from the wound. In case adhesions prevent such delivery, the retractors are retained and used to make the appendix more accessible.

The mesenteriolum is now tied off with one or more ligatures passed with an aneurism needle, and if necessary this structure is stripped away from the cæcum a short distance so that it will not interfere with the passage of a purse-string suture around the base of the appendix.

The appendix is then grasped in a piece of gauze in the left hand of the operator or by an assistant, according to convenience, and held vertical, while, with a straight needle threaded with fine silk, or fine catgut, or Pagenstecher thread, a purse-string suture is passed around the base of the appendix through peritoneal and muscular coats of the cæcum a half centimetre or more from the junction of cæcum and appendix. Opposite the beginning and ending of the purse-string a loop of the suture is left long in order to facilitate the inversion of the stump. A small wet pad is then placed on either side of the base of the appendix to protect the cæcum from accidental injury by the cautery.

The appendix is then seized transversely close to its base with a Kocher artery clamp and crushed. A second clamp is applied just distal to the first. The appendix is again crushed, the clamp is removed and reapplied distal to the crushed section. The appendix is then amputated between the two clamps

with the Paquelin cautery, and the cauterization of the proximal portion is continued until nothing projects beyond the remaining clamp but a little carbonized tissue. This is wiped away. The wet pads and the clamp are removed. The operator seizes the two ends of the purse-string suture with his right hand and the opposite loop with his left, while an assistant catches the edges of the appendical stump with a delicate pair of artery forceps, the so-called "mosquito clamp," and while the suture is held tight on either side depresses and thus inverts the appendical stump. The suture is then gradually drawn tight and tied. A second protecting suture is passed outside the first, and tied. At least such is my own practice.

Other methods in use are: 1. Amputation of the appendix with scissors, cauterization of the interior of the stump with cautery or carbolic acid, ligation with fine chromic gut or silk.

2. Amputation with the cautery, ligation of the stump beyond the cauterized area, a method used when the inflammatory infiltration of stump and cæcum prevents inversion.

3. Amputation with scissors or knife after creating a peritoneal sleeve, inversion by a purse-string suture without cauterization. A method now seldom used.

4. Amputation by scissors or cautery. A single suture of fine catgut is passed from side to side through the peritoneal and submucous coats of the appendix and loosely tied; this suture is grasped with forceps and used to invert the stump while the purse-string suture is tied.

5. When the appendix is gangrenous to its base, the gangrenous tissue is cut away and the hole in the cæcum is closed by suture like any other intestinal wound.

My own preference is for the first method described, yet all have yielded about equally good results.

We have had no case of appreciable hemorrhage into the bowel from the appendical stump, nor have we used the more elaborate sutures for inversion of the stump intended to guard against this accident. Proper hæmostasis before the appendix is amputated and the use of the cautery appear to me to be sufficient safeguards.

Treatment of the Peritoneal Exudate.—In the New York

Hospital we have practically given up irrigation of the interior of the abdominal cavity for removal of inflammatory exudates, and we believe that our results have been much improved thereby. We remove the fluid, whether serous, sero-purulent, or purulent, by means of an aspirating nozzle, devised by Drs. Kenyon and Pool, attached to a rubber tube passing to a large bottle which is connected with a modified Sprengel pump operated by steam or a current of water. The pump is of the type commonly known as an "ejector"; it is inexpensive and does not get out of order. The steam is at pressure of 90 pounds as used by us, but 30 pounds pressure is sufficient. In one of our operating rooms the pump is operated by a current of water; it is efficient, but less powerful suction is produced than by steam. The nozzles are made in three sizes, such as are used in the abdomen. The second size is the one most often used. If desired, it may be used as an aspirator and irrigator at the same time. As applied to the fluid peritoneal exudates, we now use it as an aspirator merely.

The nozzle is gently inserted into the abdomen, into pools of exudate, or in directions where it is believed fluid will be found. It is very rapid in operation, and a large amount of fluid can be removed very quickly. The trauma is very slight, far less than by any method of irrigation, new fields of infection are not created, and the infectious material is very completely removed. We believe that our results in bad cases of diffuse purulent peritonitis have been greatly improved by this method of removing pus from the abdomen. Thus, within the past few weeks ten cases of this type have been operated upon in the hospital without a death, seven by my associate, Dr. Hitzrot, and three by myself. The apparatus has, of course, a very wide field of usefulness outside the abdomen, as already pointed out by Kenyon and Pool,¹ but in these cases of wide-spread purulent peritonitis we believe it to be extremely valuable.

In exceptional cases the McBurney incision is not used:

1. In very stout patients with an acute appendicitis, a vertical cut is made through the right rectus muscle.
2. In cases where a retrocæcal abscess is probably present,

a cut is made parallel with the fibres of the external oblique, but above and behind the usual incision, practically the middle one-third of Koenig's incision for exposing the kidney and ureter. Better access and drainage are thus obtained, the last being important, since these cases are often complicated by an extensive retrocolic gangrenous cellulitis.

3. In women, when as it sometimes happens it is impossible to differentiate an acute right-sided salpingitis from appendicitis, or when appendix and tube are both involved in the same inflammatory mass. In these the cut is made in the median line, below the umbilicus.

Drainage.—(a) Interval cases and acute cases with no involvement of other structures than the appendix are closed without drainage.

(b) Abscess cases are drained by a cigarette drain of gauze, surrounded by rubber tissue, or, if a continued discharge of thick pus is expected for some days, by a rubber tube split and filled with gauze. The remainder of the wound is closed by sutures.

(c) When connective-tissue sloughs are expected to form, a tube and a rather thick cigarette drain are inserted, and but few sutures.

(d) When a distinctly purulent exudate has filled the bottom of the pelvis, a long cigarette drain, sometimes a large rubber tube split and filled loosely with gauze, is introduced to the bottom of the pelvis. A second small drain is sometimes passed to the appendical stump.

When the appendix is gangrenous and a small amount of brownish fluid exudate lies free in the vicinity, the wound should not be closed tightly about a drain. Room should be left around a thick cigarette drain for inspection of the deeper portions of the wound, and this, more particularly, in patients who are not young.

In ordinary cases of perforation with a seropurulent or purulent exudate a cigarette drain of moderate size is led to the stump of the appendix. The remainder of the wound

¹ Surgery, Gyn., and Obstetrics, Dec., 1909, pp. 675-678, *An Apparatus for Aspiration*.

is closed by sutures. In these cases the drain is sometimes omitted and if placed is removed early.

No definite date can be given for the temporary or permanent removal of drains; the indications vary too much in individual cases. In general the simpler the case the sooner the drain is removed permanently.

After-treatment.—All cases of severe general infection are put upon the Murphy irrigation at once. Morphine is omitted if possible. If the patient is doing well, small quantities of liquid food are allowed at the end of 24 hours. The use of ice-water coils on the abdomen in cases of diffuse peritonitis has been abandoned. All the different postures advocated by various surgeons have been tried. At present, ordinary cases are left in the flat dorsal position. Cases of extensive peritonitis are sometimes placed in the Fowler position for 48 hours. On the third day, castor oil or calomel in divided doses is usually given, followed by an enema in 12 hours, if nothing happens. After the bowels have moved freely, a regular diet is gradually resumed.

Interval cases are allowed to sit up on the ninth day, and to walk on the tenth day. There is no rule for the acute infected cases.

Wound infection in clean cases is exceedingly rare. Even in cases long drained, post-operative hernia is very rare when the intermuscular incision has been used.

Results.—Among 111 cases of appendicitis operated upon in the second surgical division of the hospital during the past year (Dec. 1, 1909–Dec. 1, 1910), there were three deaths, a mortality of 2.7 per cent., less than 3 per cent.

Among 118 cases operated upon in the first surgical division there were 5 deaths, a mortality of 4.22 per cent.

Among interval cases there has been, so far as I am aware, no mortality for several years.

The percentage of interval cases operated upon has been small. Most of our cases are received after localized abscess is well developed, or after perforation with a wide-spread purulent peritonitis, or after perforation with a progressive fibrinopurulent peritonitis with numerous purulent loculi in typical situations.

The bad and fatal cases have been of the two types, namely, gangrenous appendicitis with perforation and intense septicæmia, a mixed infection with streptococci and saprophytic organisms and with poor resistance, or perforated retrocæcal appendices with gangrenous cellulitis of the retrocolic connective tissues.

As stated, the treatment of the appendical stump has been of various kinds. We are unable to say that any one method is the best.

The number of fecal fistulæ has been small, nor have they appeared to be more frequent after any particular method of treatment. They have, as a rule, healed without operative interference, after rest in bed, packing of the wound with gauze, stimulation of the granulations, and other simple measures. None, so far as I can recall, have demanded operative interference during the past year.

The cases may be grouped under the following heads:

1. Acute catarrhal (*a*), 81, or 36 per cent.
2. Chronic catarrhal (*a*), 59, or 26 per cent.
3. Abscess (*a*), 32, or 14 per cent.
4. Gangrenous (*a*), 43, or 18 per cent.
5. Suppurative (*a*), 14, or 6 per cent.

Many of the cases recorded as "acute catarrhal" have in reality been cases of suppurative appendicitis, in which the appendix has been filled with pus, ulcerated in its interior, almost perforated, and in which a considerable quantity of seropurulent fluid, often sterile, has been found free in the cavity of the peritoneum.

CONCLUSIONS.

1. Acute appendicitis should be operated upon at once.
2. The appendix can and should be removed in all cases, except when excessive trauma would be created by such removal.
3. The treatment of the stump by any of the methods in common use gives good results.
4. Aspiration of fluid exudates is preferable to irrigation.
5. A large proportion of acute cases demand some form of drainage, brief or prolonged.

DIVERTICULITIS OF THE RECTUM.

A REPORT OF TWO CASES OPERATED UPON, ONE OF THEM WITH
CARCINOMATOUS DEGENERATION.

BY H. Z. GIFFIN, M.D.,
OF ROCHESTER, MINNESOTA.

EXTIRPATION of an inflammatory mass secondary to diverticula in the rectum seems to be unique in surgery. Telling,¹ in his exhaustive review of the literature up to 1908, reports no such case. In a personal review of the literature from January, 1902, to November, 1910, I have been unable to find a recorded instance.

Yet there are reasons for believing that the condition should not be quite so much of a rarity. From pathologic reports, we know that diverticula occur in all parts of the intestine, though undoubtedly most frequently in the sigmoid, splenic flexure, and appendix. In 88¹ cases with diverticula in the large bowel (postmortem), the rectum was involved in nine; and at autopsy the rectum is generally the least thoroughly examined portion of the colon. In 63 cases of vesicocolic fistulæ, Cripps² reports communication with the rectum in 25, the majority of which were inflammatory. Of 15* operations performed in the Mayo Clinic, St. Mary's Hospital, from 1902 to 1910 inclusive, for diverticulitis of the large bowel, two have been done for diverticulitis of the rectum. Moreover, diverticulitis of the rectum simulates carcinoma clinically and macroscopically, and surgical pathologists are probably not on the lookout for the condition.

On the other hand, we can be quite certain that diverticulitis of the rectum is not of frequent incidence. Many pathologic reports state definitely that the occurrence of

* To be reviewed. See also Mayo, Wilson, Giffin, Surg., Gyn. and Obst., July, 1907.

diverticula ceases abruptly with the *appendices epiploicæ* at the beginning of the rectum. Hartwell and Cecil³ review 18 cases of intestinal diverticula, no one of which shows rectal involvement. That the rectum is protected by firmer surrounding tissues, that the musculature is stronger (Schreiber⁴), that internal pressure from accumulated fæces is less constant and peristalsis less active, make it probable that diverticula are less common here than in the sigmoid.

Of the nine cases above referred to, in which diverticula were found in the rectum postmortem, seven were purely pathological and two were surgical as well. In these two an enterostomy was done for obstruction. The abstracts are as follows:

(Rotter, 1897.⁵) Male, fifty-three years of age. Stenosis and sigmoid ileac fistula. Symptoms of obstruction for six months. No previous constipation. Operation as for perityphlitis; artificial anus at end of ileum.

Necropsy.—In the upper rectum a stricture 4 cm. long and 3 cm. thick, with narrowing to the size of a lead-pencil was found. Above the stenosis the mucosa was rugose with several fine openings leading to fistulous tracts; these were narrow and communicated with the lumen of the gut and with a small abscess cavity; this was adherent to the vermiform appendix and was in fistulous communication with a loop of the small gut. The condition was regarded as secondary to a former appendiceal abscess.

(Herczel, 1889.⁶) Male, forty-eight years of age. Irregular bowel action. Five months symptoms of enterovesical fistula with passage of air and fæces per urethram. Stricture of the bowel 12 cm. from the anus; tumor felt in the left iliac fossa. Carcinoma of the sigmoid flexure diagnosed. At operation the bowel was found to be adherent to the bladder. Subsequent colotomy and death.

Necropsy.—Multiple diverticula containing fecal matter were found in the whole of the rectum; one had given rise to a fistula. Stenosis of the bowel; small abscess cavity outside of it. The fistula was twenty-six centimetres above the anus.

The seven remaining, purely pathologic, cases are as follows:

(Patel and Pellandra, 1906.⁷) Female, seventy years of age. Died from pulmonary accidents. Multiple diverticula in the descending colon, the sigmoid flexure, and the upper rectum.

(Kliven, 1906.⁸) Female, sixty-two years of age. Double row of pouches (over 40) running down the sigmoid flexure on to the upper

part of the rectum, containing fæces and concretions. All opposite the mesentery.

(Fischer, 1899.⁹) Male, sixty-four years of age. Arteriosclerosis with chronic passive congestion. Twenty-five diverticula in the descending colon, the sigmoid flexure, and the rectum; mostly in the two latter places. They were situated near the mesenteric attachments. Adhesions around involved the bowel.

(Fischer, 1909.⁹) Male, forty years of age. Chronic passive congestion in cardiovascular disease. Twenty-five diverticula were found in the rectum.

(Condit, 1902.¹⁰) Female, seventy years of age. Chronic nephritis, bronchitis, emphysema, and congestion. Numerous diverticula in the ascending colon (where there were few only) to the upper rectum in two irregular rows on either side of the mesenteric border. They contained small, hard, fecal masses. Some inflammatory changes in the walls.

(Hale White, 1885.¹¹) Male, fifty years of age. Suppurative peritonitis; no previous history. Numerous diverticula from descending colon to the first part of the rectum. Nearly all of the diverticula contained fæces and entered the *appendices epiploicæ*.

(Morison.¹²) Male, fifty years of age. Stout. Three years symptoms of vesico-intestinal fistula.

Necropsy.—The sigmoid flexure was thickened and narrowed at the juncture of the first and second parts of the rectum, the gut being constricted by a narrow membranous band so that the lumen just admitted the tip of the little finger; stenosis of the gut, in all, three inches. Above and below the constriction were several "pits" in the mucous membrane; some were ulcerated at the extremity. A probe was passed from the bowel through one of these into an abscess cavity and thence to the bladder. (The diverticular origin of this case was not recognized by the author.)

Since the publication of Telling's article, from which the above abstracts have been obtained, I have not been able to find additional cases in clinical or pathological literature. The clinical literature has been reviewed to November, 1910. The pathological to October, 1910 (inclusive).

Diverticulitis of the sigmoid has been clearly established within the last ten years as a surgical entity. Diverticulitis of the rectum has apparently been unrecognized surgically. The report of the following cases is therefore of interest.

CASE A38329 (Hospt. 35651).—Mrs. F. C., aged fifty-six years, was examined on June 1, 1910. The family history was negative save that the mother died of carcinoma of the breast at the age of thirty-four. The patient had three children, the

youngest thirteen years old. Menstruation had ceased four years previously. The patient had been unusually healthy and had had no previous illness.

For nine years she thought there had been an excessive amount of mucus in the stools. For three years there had been a sensation of bearing down in the pelvis and an increasing difficulty in moving the bowels, together with a sensation of narrowing of the bowel. A dull ache was present in the rectum at times. No blood had been seen in the bowel movements. There had been very little loss of flesh. No urinary, gastric, pulmonary, circulatory, or other complaints were elicited.

Upon proctoscopic examination, what was considered to be a low-lying rectal cancer was found. Physical examination otherwise was negative.

On June 11, 1910, a Quenu-Tuttle perineal operation for low-lying tumor of the rectum was done by W. J. Mayo. The tumor was about four inches in length, producing marked obstruction. Extensive attachment to the vagina and other pelvic structures was found.

The pathologic examination of the specimen revealed two quite perfect diverticula with their surrounding inflammatory mass constituting the "tumor." A report received Jan. 1, 1911, stated that the patient had been gaining slowly in strength. There was, however, very little control of the bowel movement.

CASE A30405 (Hospt. 35351).—Mr. M. D., aged forty-eight years, was referred by Dr. Kenelm Winslow, of Seattle, Washington, and examined May 9, 1910. The family history and personal history were negative. Seven months previously the patient had noticed blood in the bowel movements; the quantity was very small at first, but had gradually increased. There was no old history of colic or obstructive attacks. No constipation. No pain. The bowels had been loose for six weeks, and the patient had lost rapidly in strength and slightly in weight (11 pounds).

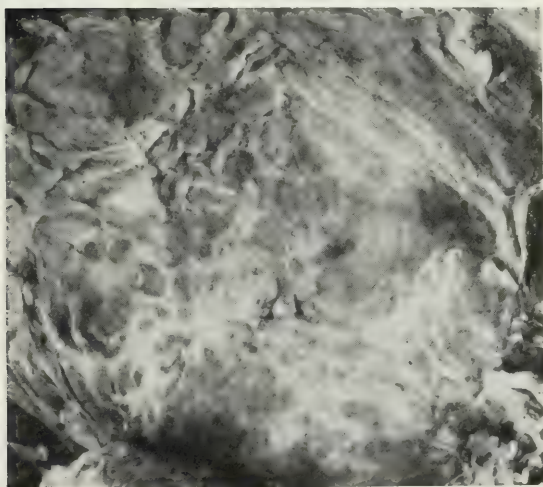
Upon rectal examination, a hard, adherent, nodular mass could be felt. Upon proctoscopic examination, a diagnosis of carcinoma was made. General physical examination revealed evidence of circulatory insufficiency. The urine contained a trace of albumin and a few hyaline casts. Blood-pressure was 190. Heart sounds were of poor quality. Hæmoglobin 76 per cent. Lungs negative.

FIG. 1.



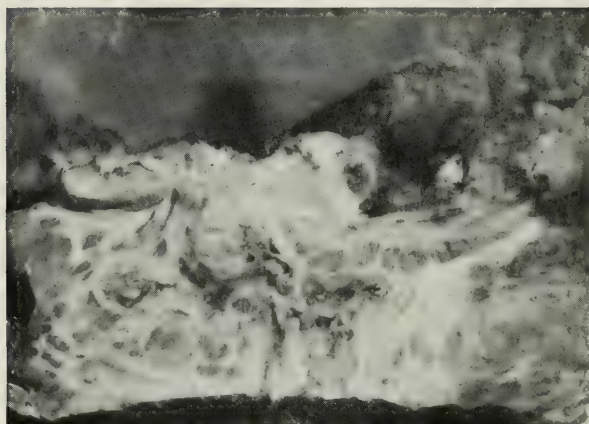
Case I (35651).— $\times \frac{3}{4}$ diam. Tumor mass surrounding lower end of rectum, showing diverticulum containing probe and area immediately to left of same, from which the second diverticulum was removed for examination.

FIG. 2.



Case II (35351).— $\times 1$. Section parallel with and close to outer surface of tumor mass in case of carcinoma of the rectum. The transverse sections of the tips of two diverticula are seen close together near the centre of the photograph.

FIG. 3.



Case II (35351).— $\times 1$. Longitudinal section through wall of rectum at right angles to the section shown in Fig. 2, and opening longitudinally, for a considerable portion of their length, the two diverticula shown in Fig. 2. At the right is seen in section the large "cauliflower" carcinoma which had its origin within the diverticula, and which, as it developed, so distorted and filled their lumina that their openings were missed when probing from the mucosal side of the tumor.

Operation.—On May 19, 1910, abdominal resection of the rectum was done by W. J. Mayo. At the operating table the condition was recognized as carcinoma, and the three precedent diverticula were discovered a few minutes later in the laboratory.†

The tumor began four inches above the anus and extended up to the lower sigmoid. The seminal vesicles were involved and had to be removed. The lower two inches of the rectum was saved and union effected by the tube method of suture. The patient made a rather slow recovery. A month later when he was in good general condition, a fecal fistula was closed. Five days after this a left-sided hemiplegia developed suddenly and the patient died.

Carcinoma apparently developing upon diverticula of the large bowel has been reported in two instances.^{13 14} Both of these were in the sigmoid. Our second case illustrates the association of carcinoma with diverticulitis of the rectum.

Inflammatory strictures of the rectum have been difficult of diagnosis, and possibly diverticulitis should be thought of as a rare cause of the condition. Doubtless too many of them have been considered syphilitic.

REFERENCES.

- ¹ W. H. M. Telling: *The Lancet*, March 21, 28, 1908.
- ² Harrison Cripps: *The Passage of Air and Fæces from the Urethra*, London, 1888.
- ³ Hartwell and Cecil: *Am. Jour. Med. Sciences*, Aug., 1910, vol. cxi.
- ⁴ Schreiber: *Deutsch. Archiv. f. klin. Med.*, 1902, lxxiv, p. 122.
- ⁵ Rotter: *Langenbeck's Archiv.*, Band lxi, 1900, p. 866.
- ⁶ Herczel: *Beiträge zur klin. Chir.*, 1889, Band v, p. 690.
- ⁷ Patel and Pallandra: *Lyon Medicale*, 1906, No. 38.
- ⁸ Kliven: *Am. Jour. of Obstetrics*, vol. liv, p. 844.
- ⁹ Fischer: *Jour. Exper. Med.*, vol. v, p. 322.
- ¹⁰ Condit: *Proceedings of the New York Pathologic Society*, April, 1902.
- ¹¹ Hale White: *Trans. Path. Soc.*, 1885, p. 215.
- ¹² Morison: *Trans. Path. Soc.*, vol. xxx, p. 326.
- ¹³ Hochenegg: *Verhandlungen der Deutsch. Gesellschaften für Chirurgie*, 31 Congress, 1902, p. 402.
- ¹⁴ Giffin and Wilson: *Am. Jour. Med. Sciences*, Nov., 1909.

† The pathologic examinations in these cases were made by L. B. Wilson. Reference is made to them in his article in the *ANNALS OF SURGERY* for February, 1911.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

*Clinical Meeting, Held at the Mount Sinai Hospital,
January 11, 1911.*

The President, DR. ELSWORTH ELIOT, JR., in the Chair.

MATAS'S ANEURISMORRHAPHY FOR POPLITEAL ANEURISM.

DR. ARPAD G. GERSTER presented a man, 45 years old, who was admitted to the Mount Sinai Hospital on Sept. 30, 1910, with a seemingly fusiform popliteal aneurism, the size of a hen's egg. On compression of the femoral artery, pulsation stopped in the tumor, but the temperature and coloring of the toes remained unchanged, though previous to compression no pulsation of the dorsalis pedis and posterior tibial could be felt.

Under artificial anæmia, on Oct. 8, 1910, the aneurism was exposed and incised, care being taken not to disturb the connections between the sac and the surrounding tissues. A semi-solid clot being turned out, it became evident that the object under discussion was an aneurism, the upper pole of which was truly fusiform, inasmuch as the entrance of the vessel was exactly polar and had the shape of a flaring cone. The lower half, on the other hand, represented a sacculated dilatation, with the orifice of exit implanted in the anterior wall, the fundus of the sac overlapping the efferent vessel by fully an inch and a half.

The restorative method of intra-aneurismal suture not appearing feasible, the afferent trunk was deligated with catgut just where its calibre began to enlarge, the orifice of exit was closed by two or three stitches, whereupon the entire cavity was obliterated by three superimposed tiers of a running catgut suture. No circulatory trouble ensued, and the wound healed by first intention. The patient was discharged on Nov. 2, and to-day there remains no trace of a tumor.

In connection with this case, Dr. Gerster spoke of the necessity of a reclassification, from the practical standpoint of the surgeon, of the various forms of aneurism. In dealing with the interior aspects of an aneurism, the surgeon must base his technic upon the recognition of the precise architecture, as it were, of the cavity he was to obliterate, a viewpoint naturally neglected by the pure pathologist.

ILEOCÆCAL RESECTION FOR TUBERCULOSIS.

DR. GERSTER showed a man, 40 years old, a tailor, who was admitted to the hospital on Nov. 4 and discharged Dec. 16, 1910. He was suffering from an active tuberculous process involving both apices, and his general condition had become much worse since the formation of a painful tumor in the right iliac fossa, accompanied by symptoms of increasing iliac intestinal stenosis. The diagnosis of ileocæcal tuberculosis was verified by an incision made on Nov. 9, when four inches of the ileum, together with the tuberculous appendix and cæcum and five inches of the ascending colon, were resected. The employment of the cæcoparietal peritoneal incision recommended by Dr. William Mayo much facilitated a clean and bloodless operation of the gut. The end of the colon was inverted and closed; then a Murphy button being fastened into the end of the ileum, an end-to-side anastomosis was rapidly done. The patient's recovery was uninterrupted and uneventful, as far as the peritoneal cavity was concerned. The button was passed in the third week. The fever due to the pulmonary process retained its character during convalescence from the operation. At present, the patient's condition is much improved; he has gained considerably in flesh and strength, and his coping with the pulmonary tuberculosis offers better chances than before resection.

RESECTION OF THE TEN UPPER RIBS FOR THE CURE OF TUBERCULOSIS OF THE RIGHT LUNG.

DR. GERSTER presented a waiter, 30 years old, who had suffered in boyhood from long-continued cough and hæmoptyses. On Nov. 7, 1908, he had a severe chill, with sharp pain and rapid breathing, and three days later he was admitted to the medical service of the Mount Sinai Hospital, whence he was transferred, on Nov. 25, to the surgical division.

After preliminary resection of the tenth rib, the evidences

of pyopneumothorax necessitated incision and drainage, which was done on the same day. The fetid discharge yielded a culture of streptococcus; no tubercle bacilli. The patient's high temperature, which was present before operation, continued unabated, and led to the conclusion that its cause must be sought in the pulmonary process, an assumption verified by the presence of tubercle bacilli in the sputa, and the continuation of the fetidity of the discharge. Evidently, a tuberculous cavity located in the right apex had perforated into the pleural sac.

As the patient was losing ground rapidly, resection of the nine upper ribs, including the first, was done on Dec. 22, 1908. Approach was made by a long incision beginning above the right clavicle, running down the back just outside of the inner margin of the scapula, and merging into the drainage wound at the height of the tenth rib. The considerations which determined this radical procedure were, first, the sound condition of the left lung; second, the fact that the seat of the destructive malady was in the upper portion of the right lung, where the pleural adhesions to the rigid skeletal framework of the chest prevented the collapse of the lung and the approximation of the walls of the lung cavity. Thus it was seen that Dr. Gerster proceeded in this case on lines of argument identical with those followed by Friedrich of Marburg. Accordingly, the scapula being freely detached from the thorax along its inner margin, it was raised and turned outwards, trap-doorwise, exposing the subscapular aspect of the chest. One inch of the first rib was removed, the length of the excised piece of each rib increasing in proportion to the total length of the rib, that removed from the ninth being seven inches. That portion of the wound which corresponded to the first four ribs was tightly packed down with gauze, and the scapula was returned to its normal position, but not sutured.

The formidable procedure was very well borne by the patient, whose fever began to abate within a week after this operation. His pulmonary symptoms, especially the copious sputa and night-sweats, disappeared by May, 1909, and the patient had gained twenty pounds in weight. He was sent to the country for the summer and was re-admitted in October. The lung by this time had everywhere become adherent to the costal pleura, and no thoracic fistula existed, but a strip of lung tissue to the extent of about ten square inches lay exposed to

view along the lower half of the extensive incision. This surface of exposed lung had a bluish-black color; it crepitated on pressure, and on being punctured with a hypodermatic needle, permitted air to escape. It also showed no tendency whatever to develop granulations from its own substance, becoming dry and leathery on exposure to the drying effects of the air. To aid final cicatrization, a long, bridge-like strip of skin, three inches wide and about sixteen inches in length, was detached on Oct. 30 from the inner margin of the original incision, and was shifted into the bottom of the cleft in which the lung lay exposed. A goodly portion of the middle of this bridge necrosed, but enough of it survived to cover the exposed lung. This plastic procedure had induced a more energetic marginal cicatrization, which, being still interrupted by occasional circumscribed cicatricial ulceration, was not yet completely finished. The lung process, however, seemed to be definitely cured.

FRACTURE OF THE FEMUR; OPEN OPERATION, WITH
INTRODUCTION OF INTRAMEDULLARY
SPLINT (ELSBERG).

DR. HOWARD LILIENTHAL showed a boy, ten years old, who was admitted to Bellevue Hospital on October 12, 1910, with a compound fracture of the femur, at the junction of the middle and lower thirds, as the result of a fall from a wagon. At the time of his admission, the boy's temperature was 102°, but it gradually fell and reached normal on October 19. There was an abrasion of the skin on the inner side of the thigh, and a small incised wound on the outer side. Before resorting to operation, traction had been tried to effect restoration of the fragments, but there still remained an inch of overlapping, as shown by the skiagram.

On October 26, 1910, Dr. Lilienthal made an incision, four inches long, antero-externally over the point of fracture, and after exposing the ends of the bone he cut through the newly formed callus and delivered the end of the upper fragment into the wound. He then scraped off some of the periosteum and intervening callus, and with a Gigli saw cut away about two-thirds of an inch of the lower end of this fragment. The sharp point of the lower fragment was removed with bone forceps, and then the marrow was removed for an inch from the ends of both fragments. An intramedullary splint of aluminum was

snugly fitted into the two ends, and after replacing the retracted periosteum, the wound was tightly closed. The interval between the ends of the two fragments after the insertion of the splint was half an inch. A dry dressing was applied, and the extremity was fixed on a posterior splint.

On November 2 a plaster spica was applied, and a skiagram, taken two days later, showed the fragments in perfect position. On Nov. 22 the plaster cast was cut away, and the wound was found healed *per primam*. Moulded splints were then applied. On Nov. 25 a skiagram showed a space between the ends of the fragments which was not firmly bridged with callus. On Dec. 5, although the knee could be passively flexed, he could not move it through more than 60 degrees. He was discharged on Dec. 31, 1910, well, without any support and walking with only a slight limp.

VESICAL CALCULUS AND HYPERTROPHIED PROSTATE.

DR. HOWARD LILIENTHAL presented a man of 60 who for the past twelve years had suffered from dysuria and paroxysmal hæmaturia, and whose symptoms finally became so aggravated that he was confined to bed.

Dr. Lilienthal first saw the patient about two months ago, and upon examination found an enormously hypertrophied prostate, and it was also ascertained that there was practically no residual urine. An operation was advised, but the patient declined it at that time. Finally, he became so wretched that he was brought to the hospital. His urine at this time had the appearance and consistency of pea soup, and an X-ray which was taken showed a large, opaque body, apparently in the upper part of the bladder. Cystoscopy was attempted, but the instrument produced such furious bleeding that nothing could be seen. That same evening, under gas anaesthesia, the bladder was opened above the pubes, and a calculus, weighing three and a half ounces, was removed. A week later, the enlarged prostate was enucleated.

RESULT OF RESECTION OF COLON FOR STENOSING CARCINOMA AFTER SEVENTEEN YEARS.

DR. HOWARD LILIENTHAL presented a man of 60, who had been operated upon seventeen years before for the removal of a stenosing carcinoma of the transverse colon, the anastomosis

having been accomplished by a Murphy button one and three-quarter inches in diameter. A number of apparently infiltrated glands were necessarily allowed to remain, yet the patient had remained perfectly well up to the present time.

This case, Dr. Lilienthal said, had been reported in full in the *New York Medical Journal* for Sept. 1, 1894.

EXPLORATORY LAMINECTOMY.

DR. CHARLES A. ELSBERG presented a man, 42 years old, upon whom he had performed a laminectomy about a month ago. The patient had been suffering from pain in the back, with marked sensory disturbances in the lower limbs, for over two years. When he was brought to the Neurological Institute, in the service of Dr. Joseph Fraenkel, he had typical Brown-Séquard symptoms, with a tender spinous process at the upper level of the sensory disturbances. The diagnosis of spinal tumor was made, and Dr. Elsberg removed the spinous processes and laminæ of the sixth, seventh, eighth, and ninth dorsal vertebræ. The pia was found much distended with fluid, and when it was incised, a considerable quantity of fluid escaped, but nothing otherwise abnormal could be found. It was impossible to state whether the fluid was localized—that is, if the condition was one of arachnoid cyst—or not.

The patient made an uncomplicated recovery from the operation, and was remarkably relieved of all of his symptoms. At the end of four weeks he was up and about, almost all of his sensory disturbances had disappeared, all the pathological reflexes had gone, and the power in the lower limbs had returned to a great extent. The patient had lost his sexual power for eight months, and that also had returned.

The patient was presented as almost well, and showed what perfect control he now had over his limbs. Dr. Elsberg said he was unable to state whether the result was due to the decompressive effect of the operation, or whether the symptoms had been the result of pressure from a localized collection of fluid.

SPINA BIFIDA OCCULTA, WITH TROPHIC DISTURBANCES, FOLLOWED BY FIBROLIPOMA OF THE CAUDA EQUINA.

DR. CHARLES A. ELSBERG presented a girl, 24 years old, who was in good health until 1901, when she had several ulcers on the back of the left leg, which were very painful. These

healed, and were followed by similar ulcers on the toes of the left foot. These refused to heal, and in the spring of 1902, one toe was amputated. During the following year she was in the Montefiore Home on account of pain in the left lower extremity and ulcers on the toes. About this time it was noted that she had some sensory disturbances in the left lower extremity.

During 1904 and 1905 several toes were amputated on account of persistent and very painful ulcers. She complained of almost continual pain in the left leg and groin, which was gradually becoming worse. In 1908 the correct diagnosis was first made by Dr. Edwin Beer. The patient had a hairy lipoma in the lumbosacral region, and a spina bifida occulta was suspected. There was anæsthesia over the left half of the labium majus and over the fifth lumbar and first sacral areas, with hypæsthesia and hypalgesia over the second, third, and fourth lumbar areas. The X-ray showed a hiatus between the fifth lumbar and first sacral vertebræ, especially on the left side.

On August 1, 1908, an operation was done, the sac of the spina bifida occulta being removed, and the adhesions between several nerve-roots and dura being separated. The patient left the hospital, improved, on August 22. She was readmitted on May 12, 1910, on account of trophic ulcers on the left foot and severe pain along the outer side of the left leg and foot. Dr. Elsberg did a laminectomy, with removal of the spines and laminæ of the first, second, third, fourth, and fifth lumbar vertebræ. Upon incising the dura, the nerves of the cauda equina were found bound together by a tumor which consisted of fatty and fibrous tissue, a fibrolipoma. It was impossible to free the nerves from the growth, which filled up the greater part of the canal. The left posterior root of the fifth lumbar nerve was thereupon divided, and the dura, muscles, and skin were then closed in the usual manner.

The patient's convalescence from the operation was almost uneventful. The trophic ulcers healed promptly, and the pain in the left leg and foot disappeared. The patient was discharged on July 17 free from all pain in the left leg, and with all the ulcers healed. The pain has not returned since, but a week ago a small ulcer appeared on the back of the leg.

ANEURISM OF THE INNOMINATE ARTERY.

DR. ELSBERG presented a man with a large aneurism of the innominate artery, upon whom he had done several preliminary operations. Four weeks ago he had tied the left common carotid artery under cocaine anæsthesia, and a week later he had tied the second portion of the right subclavian, also under local anæsthesia. The last operation was exceedingly difficult on account of the large number of dilated veins which were encountered. The right radial pulse at once disappeared, and could not yet be felt. The aneurism at first diminished considerably in size, but subsequently again grew larger. The patient complained of very severe pain in his right upper extremity, and was anxious to have anything done which might give him a chance of life. He was willing to take any risk, no matter how dangerous the operation. Dr. Elsberg asked whether, in the opinion of the members of the Society, an intrathoracic operation would be considered justifiable, and whether one might not attempt to do an external aneurismorrhaphy. The dangers and difficulties of such an operation were certainly very great, but in such a hopeless case were not heroic measures justified?

DR. WILLIAM C. LUSK, discussing Dr. Elsberg's case of aneurism, said that at a meeting of the Society last spring, he had presented the specimen of an innominate aneurism reaching to just below the patient's chin, which had been treated with gold wire and galvanism, four of such treatments having been administered. This treatment was attended by marked benefit to the patient, who lived a year and eight months after the first employment of it, and finally died without rupture of the sac. Following three of the wirings when considerable of the introduced wire came in contact with the intima, marked benefit resulted, but after the other wiring when a stiffer filament was used, which was snarled by twisting during its introduction so that it lay more or less centrally within the sac, as demonstrated by an X-ray, no benefit whatever accrued to the patient. The post-mortem specimen showed that those loops of the gold wire which had come in contact with the sac wall lay in a fibrin deposit, while the loops which projected centrally were uncoated and untarnished. In a series of 88 experiments on dogs, the charring of the intima by the electrified wire seemed to be an essential feature in the formation of a permanent clot which

would adhere to the arterial wall. While the wiring of this innominate aneurism, on each of the three occasions it was successful, promptly relieved the patient's distress and made his life very comfortable for the time being, yet it would only temporarily arrest the growth of the aneurism. One striking feature resulting from the treatment of these large aneurisms with gold wire and electrolysis, already recorded by Hare and noted in this case, is the promptness with which the patient is relieved of his suffering. During animal experimentation it was found that a gold wire alloyed with 20 per cent. platinum would not disintegrate under the influence of electrolysis.

RESULT OF OPERATION FOR CARCINOMA OF THE LARYNX AFTER FIVE AND A HALF YEARS.

DR. A. V. MOSCHCOWITZ presented a man, 65 years old, who was admitted to Mount Sinai Hospital on June 12, 1905. He stated at that time that for over thirty years he had suffered from a cough, with mucous expectoration; no blood. About six months prior to admission he began to suffer from slight, gradually increasing aphonia, some dyspnœa, and a tickling sensation in the region of the larynx, particularly on deglutition. The latter symptom had progressed to such a degree that it amounted to a pronounced dysphagia, and the patient became greatly emaciated, having lost over fifty pounds in weight. Examination of the larynx revealed an endolaryngeal carcinoma, apparently springing from the left vocal cord.

An operation for extirpation of the larynx was done by Dr. Moschcowitz on June 16, 1905. The speaker said that as he had always dreaded post-operative pneumonia in these cases, and as he was of the opinion that the greatest danger of such an occurrence was within the first few hours after such an operation, when the discharges invaded the still insensitive trachea and were not coughed up, he decided to do the operation under local anæsthesia, especially as this patient already suffered from emphysema. The operation was done at one sitting, that is, without any preliminary tracheotomy. The trachea was not divided until the larynx was completely mobilized. The stump was fastened by silk sutures into the jugulum, and the pharynx was closed as completely as possible.

There were no post-operative complications so far as the respiratory organs were concerned, but the pharyngeal sutures

gave way, necessitating feeding by means of a stomach tube. When the wound finally cicatrized, the canula was removed, and the patient had worn none since. He gained over sixty pounds in weight, and at the present time, nearly six years after the operation, he could fairly be considered as cured.

The specimen in this case, which was also shown by Dr. Moschcowitz, showed an infiltrating carcinoma at the level of the true vocal cords. The growth was bilateral; the left cord had entirely disappeared, and the right was to a large extent replaced by the growth.

SIMULTANEOUS LIGATION OF BOTH EXTERNAL ILIAC ARTERIES FOR SECONDARY HEMORRHAGE FOLLOWING BILATERAL URETEROLITHOTOMY.

DR. MOSCHCOWITZ said that this case was reported in detail in the ANNALS OF SURGERY in December, 1908. The patient was operated upon by him on July 20, 1908, the operation consisting of a bilateral ureterolithotomy for the removal of two calculi from the pelvic portion of each ureter. Both lateral extraperitoneal incisions were closed by layer suture down to a rubber tube drain, which led to the sutured incisions in the ureters. Primary union followed, and the stitches were removed on the sixth day.

Exactly one week after the operation, there being no leakage, Dr. Moschcowitz decided to remove the drain on the left side. The tube came away easily, but was immediately followed by a tremendous hemorrhage, which stopped for an instant, and then recurred in sufficient quantity to fill a two-quart pus basin. A finger was promptly introduced, which instantly controlled the bleeding. The patient was then anæsthetized, and the wound reopened. A hole, sufficiently large to admit the tip of the little finger, was found just at the point where the drainage tube had crossed the artery. The artery was ligated above and below the perforation and the wound was packed.

Dr. Moschcowitz said he was just congratulating himself upon a narrow escape, when the sheet covering the patient caught in the safety-pin holding the tube in the right side, and pulled it out about half an inch. This was immediately followed by a terrific hemorrhage, traced to a similar accident to that on the left side, and which required ligation of the right external iliac.

Despite the enormous loss of blood, the patient recuperated

nicely, and was discharged, well, on Sept. 4, 1908. Notwithstanding the ligation of both external iliac arteries, there were never any indications of serious interference with the circulation of the lower extremities.

At the present time, about two and a half years after the operation, the patient was in perfect health, with the exception of a slight pyelitis. He was able to attend to his business, which was that of a small shop-keeper, requiring him to be on his feet many hours daily. He felt slightly tired when beginning to walk, but this soon wore off. He had a very small hernia in the centre of each scar, for which he wore a belt; this caused him no inconvenience, and he declined operative repair.

DR. WILLY MEYER stated that, in attempting to explain the fortunate outcome in Dr. Moschcowitz's remarkable case, it seemed plausible to assume that the pressure of the drainage tubes exerted on both external iliacs for six days was sufficiently strong, not only to produce the pressure necrosis of the arterial wall, but to encourage the establishment of sufficient collateral circulation by way of the internal iliacs as well as the epigastrics. That the latter route suffices to a great extent to save the extremity from total gangrene, he had once observed after simultaneous ligation of both internal iliac arteries for hypertrophy of the prostate, done in 1893. On account of a secondary hemorrhage from the external iliac artery on the one side, on the twelfth day after operation, due to pressure necrosis produced by an artery clamp, which had to be left in place on that one internal iliac artery, the common iliac had to be tied. The toes and a part of the metatarsus only became gangrenous, otherwise no special interference with circulation set in.

The main point in this as well as Dr. Moschcowitz's case was, that the vein had not to be tied in conjunction with the artery.

TETANUS FOLLOWING A COMPOUND FRACTURE OF THE SKULL.

DR. MOSCHCOWITZ presented a girl, twelve years old, who was admitted to Mount Sinai Hospital on October 2, 1910, when the following history was obtained: Thirty-six hours prior to her admission she was struck on the head by a flower-pot, filled with earth and a plant, which fell from a considerable height. She was unconscious for five minutes. The resulting scalp wound was sutured at a nearby dispensary, but on the

following day she complained of such severe headache, with pain in the wound, and vomiting, that she was brought to Mount Sinai Hospital. There an infected scalp wound was found, about three inches long, held together by three silk sutures. These were promptly removed, with the escape of about two drachms of bloody purulent fluid. Bare bone and a non-depressed fracture of the skull were then made out.

After this the child felt perfectly well, and was soon up and about in the ward, waiting for the separation of a small sequestrum. On October 23, the twenty-fifth day after the injury, the patient began to complain of general malaise, severe headache, and pains all over the body, particularly in the muscles of mastication. Convulsions developed, during which the tongue was repeatedly bitten, and trismus and risus sardonicus were present: the typical picture of a well-developed tetanus. A culture taken from the wound discharges at this time was negative.

In the course of the next three days, the patient, in addition to the usual sedatives, received 25,000 units of antitoxin injected locally in the region of the injury, subcutaneously, intravenously, and intraspinally. During this time the disease ran a rather severe course, then improvement was noted, which thereafter progressed rather rapidly, with disappearance of all the symptoms.

DR. ARPAD G. GERSTER said, with regard to the long period of incubation in this case, that his own explanation of this, which seemed to be plausible but was of course unproven, was that while the infection occurred at the time of the fracture, the infectious material became lodged in necrosed bone, and did not come in immediate contact with the capillaries. When the necrosed bone was finally cast off, the infectious material then came into direct contact with the capillary circulation, and active symptoms developed.

SUPPURATIVE PORTAL PYLEPHLEBITIS.

DR. MOSHCOWITZ presented an unmarried woman, 26 years old, who was admitted to the Mount Sinai Hospital, in the service of Dr. Morris Manges, on July 30, 1910. Not only was the patient apathetic on account of the severity of her illness, but she was also of so low a degree of intelligence that it was almost impossible to obtain a correct history or make an accurate physical examination. It appeared that her illness had begun

two weeks before, with high fever, headache, cough, and coryza. One week prior to admission there had been repeated vomiting, with chills and high temperature, followed by profuse sweating.

The physical examination, upon admission, was entirely negative. It was particularly noted that the liver was not enlarged, although the edge of the spleen could be felt one finger's breadth below the free border of the ribs. The white blood count was 12,200, with 80 per cent. of polymorphonuclears. Blood culture was negative. The temperature fluctuated between normal and 106° F.

While the patient was under observation on the medical side of the hospital, examinations of the blood showed what were taken to be malarial plasmodia, but when placed upon quinine she very promptly developed an amaurosis, without any effect upon the chills and temperature.

On August 9 the scleræ were icteric, and for the first time there was noted a distinct enlargement of the liver, to the extent of two fingers' breadth below the free border of the ribs. The leucocyte count gradually rose to 33,600, with 89 per cent. of polynuclears.

The patient was transferred to the surgical side of the hospital on Sept. 3, 1910, with the probable diagnosis of portal pylephlebitis, without any discernible point of entry. Dr. Moschcowitz first made an exploratory incision through the upper part of the right rectus, and found the liver congested and enlarged, with the right lobe adherent superiorly to the diaphragm. The condition of the patient did not warrant any extensive exploration. Therefore the incision was rapidly closed, and the ninth rib resected in the anterior axillary line. The pleural surfaces were sutured together, and upon incising these and the underlying diaphragm, a cavity containing about four ounces of thick pus was evacuated. The liver itself was also aspirated, and pus being obtained, though only in small amount, this was also drained by means of tube and gauze.

In spite of the drainage thus established, the patient continued to run a very high temperature; she gradually lost ground for about a month, and became greatly emaciated. The upper cavity discharged pus; the lower one pus mixed with bile. Gradually, however, the cavities assumed a cleaner appearance, the patient's general condition improved, and she was discharged, cured, on Nov. 22, 1910.

Dr. Moschcowitz said the diagnosis in this case was based upon the course and symptoms of the disease, and, above all, upon the operative findings. On account of the patient's recovery there was room for doubt whether or not it was a true case of portal pylephlebitis. The speaker said he could recall three other cases at Mount Sinai Hospital, which were believed to have been true cases of portal pylephlebitis, which terminated in complete recovery, but strict proof was lacking and therefore he did not care to discuss them further. There was one case, however, which he wished to place on record, and he did so by the courtesy and permission of Dr. Gerster, whose private patient the case was. That patient was a girl, seven years old, who had had a number of chills prior to an operation for acute gangrenous appendicitis, with perforation. Her relatives were informed of the gravity of her condition, and were warned of the seriousness of the case if the chills recurred after the operation. Another chill occurred two days after the operation, and thereafter they occurred regularly for two or three weeks, with the temperature varying between normal and 106° F. The liver and spleen became painful and enormously enlarged; icterus developed, and the child became greatly emaciated. An exploratory operation was repeatedly advised by some of the medical men in attendance, but the idea was rejected by Dr. Gerster. During the fourth week, the chills and fever gradually declined in intensity and frequency, with abatement of all the symptoms, and recovery ensued. Following this, the child remained in perfect health for four years, when she was seized with frequent attacks of very profuse hæmatemesis which were attributed to gastric ulcers. No operation excepting a transfusion was done, and the patient died. Post-mortem examination did not reveal a gastric ulcer, but in the liver there were evidences of a diffuse miliary suppuration, which had evidently healed.

Stated Meeting, held at the New York Hospital, January 25, 1911.

The President, DR. ELSWORTH ELIOT, JR., in the Chair.

ANKYLOSIS OF THE JAW (THREE CASES).

DR. FRANK HARTLEY presented the following patients: A schoolgirl, ten years old, who in 1902, six months after an attack of scarlet fever and diphtheria, noticed that her jaw was becoming

stiff, and motion was difficult. Within a few weeks the teeth were about one-quarter of an inch apart, and the jaws could not be moved at all. The patient had to feed herself by placing the food behind her molar teeth.

Examination showed complete ankylosis of the inferior maxilla. The chin was markedly receding, with atrophy of the lower jaw. The teeth were in poor condition. An operative scar was present behind the right ear, at the upper end of which pulsation could be felt through a small, bony defect. This, according to the history, was the result of an extradural abscess operation which was done at the Post-Graduate Hospital in 1908.

On January 5, 1909, Dr. Hartley exposed the right ramus and divided it at the angle with a Gigli saw. The cut ends were then rongeured away for about half an inch at the upper border and one inch at the lower, and an attempt was made to open the jaw. This was impossible, as the opposite side was also ankylosed. The pterygoid and masseter muscles were then united over the extremity of the ramus, and the mucous membrane was closed with plain gut sutures. The skin was sutured with silk, and the wound healed by primary union.

The second operation on this patient was done on March 6, 1909. The temporomaxillary articulation of the left side was exposed by a curved incision, beginning behind the ear, extending over the top and down about three-quarters of an inch anteriorly; then horizontally for three-quarters of an inch (Kraske). The pinna was reflected downward and backward, exposing a hard mass of bone joining the inferior maxilla to the temporal bone. By means of electric bone drills and fine chisels this was divided, and it was then found possible to move the jaw. The bone was then cut away with the rongeurs until the jaws could be separated for a distance of an inch and a half. A fossa was then formed in the temporal bone to receive the ramus. The wound was closed, with drainage, and the patient was discharged on April 17, 1909. She was now able to open the jaw so that the incisor teeth were over an inch and a half apart. The recovery of motion in the jaw has been much assisted by the use of a double plate, with springs inserted, which she wore two hours daily.

January 25, 1911: Lateral motion in lower jaw is good. The inferior maxilla can be depressed two inches from the upper teeth. Muscular power is good.

The second case was a boy, 17 years old, who was admitted to the hospital on April 27, 1910. The history obtained was that five years before, he had fallen, fracturing the right ramus of the lower jaw. It was set by a physician, with apparent recovery. He was able to chew without discomfort, and could open his mouth as well as before the accident. A small, hard lump has appeared at the site of the fracture. This has increased in size since the accident. Not painful.

About two months ago the boy noticed that he could not open his mouth as widely as formerly. Gradually, since then, motion had become more and more restricted until the teeth of the upper and lower jaws could not be separated more than half an inch. He had considerable pain at the back of the jaw when attempting to chew. Otherwise, the patient was in excellent health. An examination showed that attached to the right ascending ramus of the mandible there was a hard tumor, about the size of a large walnut; this was firmly fixed to the ramus and apparently also to the zygoma. The lower jaw was ankylosed.

On May 13, 1910, Dr. Hartley made an incision, about five inches long, beginning at a point behind the midportion of the external ear, following the border of the concha around to a point on a level with the temporomaxillary articulation in front, and then extending horizontally forward for one inch (Kraske). The ear was then retracted downward out of the way and the muscles and other tissues cut through and retracted. The zygoma was divided, and a portion cut away with the chisel and drill. This freed the articulation, and the condyloid process was rongueured and chiselled away, along with a portion of the temporal bone. The distance between the ramus and the temporal bone was three-quarters of an inch. The jaw could now be widely opened without difficulty.

The wound healed well, and the patient's convalescence was rapid and uneventful excepting for a mild bronchitis, which developed on the eighth day after operation. The patient left the hospital on May 25, twelve days after the operation. He was now able to separate his jaws for an inch and a half; lateral motion was present and there was no pain. January 25, 1911: Jaws separate $1\frac{3}{4}$ inches. Lateral motion and power are good.

The third patient was a married man, 40 years old, a peddler by occupation, and a native of Austria, who was admitted to the New York Hospital on December 29, 1910. His family his-

tory was negative. He had typhoid fever when a youth, and has had psoriasis for the past sixteen years. No history of rheumatism; denied venereal infection.

Six years ago the patient was confined to bed for six months with a fever, accompanied by frequent chills. He had no swelling of the joints at that time, but there was considerable tenderness over his temporomaxillary joints and knees. Since that time the temporomaxillary joints had gradually become ankylosed, and at present he could not open his mouth nor chew. Several of his phalangeal joints were also involved. Dr. Hartley said it was interesting to note the combination of psoriasis and multiple joint affections, to which reference had been made in literature (Menzen, *Archiv. für Derm. u Syphilis*, 1904, lxx. Wollenberg, *Berl. klin. Wochenschrift*, 1909, xlvi).

On January 11, 1911, the left temporomaxillary joint was operated on by the Kraske method with extensive removal of bone, the same method being followed as in the previous cases. Twelve days later the opposite side of the jaw was operated on in the same way. The patient was now able to open his jaw fully two inches, and there was also lateral mobility, but the second operation was done so recently that the wound had not yet healed.

Dr. Hartley said that in doing this operation for ankylosis of the jaw he followed the Kraske method, excepting that with the electric burr he was able to remove more bone and to polish the surfaces of the ramus of the lower jaw and temporal bone, and thereby he obtained a more permanent nearthrosis than could be secured by other bone instruments. The use of the burr seemed to be the best means of removing the superfluous bone.

The various operative procedures used in this operation, Dr. Hartley said, showed how imperfect the results were. His personal experience covered eight cases. Where the ankylosis was due to connective-tissue bands following destruction or loss of tissue between the temporomaxillary articulation and the angle of the jaw, Esmarch's operation with Rochet's modification, consisting of the interpolation of muscle, was undoubtedly the best, unless the disease was bilateral.

Mears, in 1883, and König later directed their attention to the temporomaxillary articulation, but by their methods of operation frequent ankylosis resulted. To obviate this, Roser tried the interpolation of gold plate, Helferich excised the root of the zygoma, with the interpolation of the temporal muscle, and

Berosowski excised the condyle alone with the interpolation of the masseter muscle. Kraske, whose operation was the one followed by Dr. Hartley, and with which he was satisfied, made a full excision of the condyloid process, leaving a space of one and a half to two centimetres. No muscle was interpolated.

NERVE IMPLANTATION.

DR. FRANK HARTLEY presented a man, 19 years old, who on September 23, 1908, caught his arm in a cigar machine, receiving an incised wound on the flexor surface of the left forearm about two inches above the wrist-joint. The superficial and deep flexors, which were divided, were repaired on the day of the injury, and the wound healed, without infection, in about a month.

Four months after the receipt of his injury the patient was admitted to the New York Hospital, complaining of sores on the index finger and thumb of the left hand, and numbness of the thumb, index, and middle fingers. Upon examination, these fingers were found to be cold, cyanosed, swollen, and glossy. No pain was elicited from pin pricks, and tactile sense was absent. There was an ulcer on the first phalanx of the thumb. Flexion of the fingers was good, excepting in the index finger. Abduction and adduction of the thumb were imperfect.

At the first operation done by Dr. Hartley (January 11, 1909) an incision was made in the region of the old scar, and the distal end of the median nerve was located. It was bulbous, and was found to be joined to a cord-like structure resembling an obliterated vein. The median nerve was found above and was traced downwards. After excising the bulbous distal end, a defect of two inches remained between the upper and lower segments of the nerve. A section of the saphenous vein was thereupon taken from the thigh, and the two ends of the median nerve, first sutured *à distance* with catgut, were inserted into the lumen of the vein and held in place with fine silk sutures inserted through the vein and nerve sheath. When the patient left the hospital, February 3, 1909, there was no sensation in the affected fingers.

He was re-admitted to the hospital ten months later, having been treated during the interim by electricity and massage under the direction of Dr. Charles L. Dana and Dr. J. Ramsay Hunt, without much resulting benefit. The thumb, index, and middle fingers of the left hand were still cold, glossy, and cyanosed, and the nail of the index finger was trophic. There were no trophic

ulcers. There was marked atrophy of the thenar eminence, an absence of tactile sense in the affected fingers, and they were also analgesic. In the other two fingers sensations were unaffected.

On February 2, 1910, Dr. Hartley exposed the median nerve and examined the site of the previous operation. The nerve, including the section of the transplanted vein, was hard and fibrous, and a piece four inches long was excised. Into the resulting defect a section of the long saphenous nerve, sixteen inches in length, taken from the patient's leg, was cut into four sections and sutured with very fine silk and completely surrounded by Cargile membrane. The wound healed within two weeks and the patient left the hospital at that time.

On January 25, 1911, eleven months after the second operation, an examination showed that the affected fingers were warm, and that tactile sensation had returned. Pain sensation could also be elicited. Both tactile sensibility and pain were less marked in the tips of the index and middle fingers than in the palm and thumb. These sensations, however, were daily becoming more distinct. The thenar eminence was filling out; abduction and adduction of the thumb were good; flexion of the fingers was still somewhat imperfect, but this had to do with the tendon suture and not the nerve.

Dr. Hartley then discussed the different methods of treatment for nerve injury, and stated that a review of the literature and statistics showed that the rapidity of the results obtained by nerve grafting, as compared with suture *à distance* and tubulation was apparent. In his own case the result of nerve grafting was obtained more quickly, more completely, and over a greater loss of tissue, even after a longer interval of time after the injury, than had followed the first operation.

INTERSCAPULOTHORACIC AMPUTATION.

DR. FRANK HARTLEY showed a man, 44 years old, who was admitted to the New York Hospital on October 5, 1910, complaining of swelling in the right shoulder and pain in the upper right arm. His symptoms were of two months' duration. His family history was negative; syphilis was denied, and he did not recall any injury to the shoulder. The pain was worse at night. Early in September he first noticed a lump over the right shoulder-blade, which had increased very rapidly in size, and recently had appeared under the arm-pit. This swelling had

not been tender and he had no pain in the shoulder-joint, although the joint had become stiff since the appearance of the growth in the arm-pit. He also complained of weakness, with drenching night-sweats, and had lost considerable weight.

Examination of the right scapular region showed a mass extending from the vertebral border of the scapula forwards to the midaxillary line. The mass was made more prominent by any movement of the scapula, and the motions of the shoulder-joint were quite limited. The overlying skin was normal in color. In the axilla there were a few prominent subcutaneous veins. The tumor was lobulated, tense, and semicystic in character; it moved with the scapula, and did not seem to be adherent to the chest wall. Aspiration at the most prominent part of the swelling gave a syringeful of bloody serum. The patient's temperature was 103° F. A blood examination showed 4,800,000 red cells, 10,300 white cells, with 74 per cent. of polymorphonuclears and 82 per cent. of hæmoglobin. The general examination of the patient was otherwise negative.

Operation, October 22, 1910: An interscapulothoracic amputation of the right arm was done. The tumor was found to spring from the under surface of the scapula; it was not adherent to the chest wall, and did not involve the bone. The patient made an uninterrupted convalescence and left the hospital twelve days after the operation. He had gained in weight; he no longer suffered from fever and night-sweats, and felt much stronger.

The pathologist reported that the tumor was a spindle-celled sarcoma, showing areas of cystic degeneration. It was encapsulated, did not involve the bone, apparently originating in the soft parts.

The important features to bear in mind in connection with this operation, Dr. Hartley said, were shock and hemorrhage. Death was usually due to shock, with or without hemorrhage. To prevent the occurrence of shock, both Cushing and Crile recommended injecting the nerve trunks with cocaine. In Dr. Hartley's case, no such preliminary injection was made, the only precaution taken being that he waited for complete anæsthetization before division of the nerves. Bloodless dissection of the tissues was the best guarantee against shock. This was his fifth case of interscapulothoracic amputation, with four operative recoveries. There was one death within twenty-four hours after operation. One patient was alive three years after operation, when he was lost sight of.

CYST OF THE PANCREAS (THREE CASES).

DR. FRANCIS W. MURRAY presented the following patients: The first patient was a female, 19 years old, admitted to St. Luke's Hospital in May, 1899. Up to the age of twelve the patient had been perfectly healthy. Then she began to suffer from attacks of what were called gastritis; these attacks, which lasted from ten days to two weeks, were accompanied by vomiting of greenish material, no blood, and during the attacks there were epigastric tenderness and sharp, shooting pains in the stomach, radiating to the back. No history of clay-colored nor fatty stools; no jaundice. Had been very constipated, and during the last month had lost ten pounds. Six weeks prior to admission a tumor was discovered in the epigastric region, and this had steadily increased in size.

Upon admission, the patient looked anæmic, and the skin was of a dirty, yellow color. The heart and lungs were normal; the stomach resonance was a little higher than normal. There was a smooth, hard, tense mass, about the size of a cocoanut, situated in the epigastric region, a little to the left of the median line, and extending into the left hypochondrium. The area of flatness began just below the stomach and extended to the level of the umbilicus: it ran also the left and backwards to the spine, its upper border being about two inches below the angle of the scapula. The right kidney was palpable and freely movable. The patient's temperature was 100; pulse, 90; respirations, 24. The urine was light colored and acid, with a specific gravity of 1010; no sugar nor albumin; it contained a few vesical epithelia.

A diagnosis of pancreatic cyst was made, and a few days later the peritoneal cavity was opened through a four-inch incision, beginning just below the ensiform and running downwards. A pearl-colored cyst was seen presenting behind the gastrocolic omentum, which was adherent. After walling off the peritoneal cavity with gauze packing, 34 ounces of a clear, straw-colored, limpid fluid were withdrawn by aspiration. As the wall of the cyst collapsed, it was drawn up into the abdominal wound, and its cavity exposed through a three-inch incision, when several more ounces of fluid were removed by sponging. The cyst was rather thin walled, lined with a smooth membrane, and extended upwards behind the stomach. No communication between the cavity of the cyst and adjacent organs could be discovered.

The incision in the cyst wall was partially sutured and was also united to the parietal peritoneum. A large rubber drainage

tube was inserted into the cyst, and the abdominal wound was closed down to its lower angle, where the drainage tube was situated. Slight reaction followed the operation, and convalescence was soon established. For about ten days, discharge from the cyst was profuse and necessitated a frequent change of dressings. The convalescence, however, was uneventful; the discharge gradually lessened, and in the latter part of June the patient was discharged, wearing a small drainage tube. The fistula was about five inches in length, and passed downwards into the left hypochondrium. The pathologist reported that the fluid removed from the cyst was alkaline, with a specific gravity of 1018; it was opalescent and contained free fat, cholesterin, and leucocytes. It emulsified fat, changed starch into glucose, and digested albumin.

For a year after the operation, a small rubber drainage tube was worn, but owing to the steady contraction of the wound in the abdominal wall it was necessary to substitute a straight silver tube, about three inches in length. This prevented any retention of secretion, was worn without discomfort, and two small daily dressings of gauze were sufficient. When, however, the patient became excited or nervous, the discharge from the sinus was much increased; at such times frequent change of dressings was necessary.

During the following three years the local condition remained about the same; the discharge continued, and repeated attempts to close the fistula by cicatrization were unsuccessful. The general condition of the patient, however, was very satisfactory. She gained in weight and strength, and suffered from no disorders of digestion. In 1902, a chemical examination of the discharge was made by Dr. Gies, Adjunct Professor of Physiologic Chemistry of Columbia University, and he pronounced the fluid as similar to a simple transudate. It contained a minimal proportion of solid matter, a maximal proportion of water, and little or no pancreatic enzyme. In 1906, by means of a probe, a small stone was felt lying near the bottom of the sinus. It was of hard consistency, and seemed to be impacted in the wall of the sinus. It was too large for extraction. This stone has gradually increased in size and at present is about as large as a white walnut. As the patient feels perfectly well and suffers no inconvenience from the daily dressing, she declines an operation for the removal of the stone. Recently, a second chemical examination of the fluid was made in the laboratory of the New

York Hospital, with results similar to those found in 1902. The fluid was slightly turbid, alkaline to litmus, specific gravity 1006. Examination for ferments revealed the fact that amylase was present, trypsin and trypsinogen absent, lipase doubtful, but probably absent, and erepsin, if present, was in very small quantity.

From the number of years the fistula has existed, and from the presence of the stone, it is likely that it will remain permanent. In that respect it is a record case, as the fistula is now twelve years old—in fact, it is the oldest one on record. X-ray picture shows clearly the stone, situated apparently near the tail of the pancreas. Dr. Murray said that the above was first reported in *American Medicine*, June 25, 1902.

The second patient was a female, 48 years old, who was admitted to the New York Hospital on May 30, 1909. Of the family history, the only noteworthy point was that several members on her mother's side died of diabetes. Three months previous to admission the patient began to experience attacks of intermittent pain in the epigastrium. A month later the pain became more or less continuous, and was combined with a throbbing sensation in the epigastric region. Shortly afterwards a small mass was noticed by the patient in the region of the stomach. Since then this mass had gradually increased in size, and pain in the back, radiating down the thighs, was complained of. Appetite was lost, and nourishment, even in small quantities, caused great discomfort. The bowels were constipated, and the patient steadily lost weight and strength. On admission, she was 85 pounds under her ordinary weight.

Aside from the abdominal signs, the physical examination was unimportant. The abdomen was soft, rigidity was absent, and there was no tenderness on pressure. In the epigastric region there was a slight prominence, with apparent pulsation, and on palpation there was found a firm mass, about the size of a cocoanut. The pulsation was transmitted and not expansile. When the patient was lying down, a bruit and transmitted heart sounds were heard, but in the erect position they disappeared. No heart sounds were heard in the back. Percussion over the mass was tympanitic, and on inflating the stomach with air, the tympanitic area was increased downwards and the stomach appeared to be in front of the tumor. The urine showed a slight increase in urobilin and was negative to the Cammidge test. There was free fat in the stools.

A diagnosis of pancreatic cyst was made, and the abdominal cavity was opened through a 5-inch median incision in the epigastrium. Upon exposing the stomach, the tumor was found to lie behind it, presenting through the gastrohepatic omentum. The tumor felt tense, nodular, and cystic in places, and the pulsation of large vessels in its walls was noticeable. A small incision was made in the gastrohepatic omentum, the cyst exposed, and after proper gauze packing in the peritoneal cavity, the sac was incised between two clamps, a suction tube introduced, and 32 ounces of a reddish-yellow fluid were withdrawn. Exploration of the cyst cavity with the finger located its point of origin in the centre of the pancreas and a little to the right of the median line. A rubber drainage tube protected by gauze was inserted into the cyst cavity, and the abdominal incision was closed down to the point where the tube emerged. The laboratory reported that the fluid removed was reddish-brown in color, faintly alkaline, with a specific gravity of 1012. Microscopically, it contained blood-cells and epithelial cells, showing fatty degeneration, and as it contained albumose, the test for proteid ferment was unsatisfactory. The specimen sent to the laboratory was insufficient in quantity to permit of a satisfactory test for the other ferments.

Convalescence was uneventful, and patient was discharged in the latter part of July, wearing a small drainage tube, which discharged a seropurulent fluid in small amount. After a month's vacation, the patient resumed her duties as an obstetric nurse until November, when, on account of nervousness and weakness, she took a rest until February, 1910. During this month, interference with drainage caused a rise of temperature of a few days' duration, followed by a free discharge of pus through the tube.

In March, 1910, a small gangrenous spot appeared on the right foot, which gradually increased in size and resisted all local treatment. In July, polyuria appeared, large quantities of urine being voided daily, there was great thirst, and the patient suffered from intense pruritus vulvæ. In September she entered the medical wards of the New York Hospital for treatment of the diabetes. Her urine was acid, with a specific gravity of 1045. It contained heavy traces of sugar and albumin, together with urates and calcium oxalate crystals. No acetone and no diacetic acid were present. A slight purulent discharge came from the sinus, and in the stools were found very small globules of fat.

Under suitable diet and medication, improvement began; the

gangrenous spot healed, and the patient was discharged, much improved, on October 18, 1910. Since that time the sinus has completely healed, the patient has gained in weight and strength, and she soon expects to resume her work as a nurse.

The diagnosis in this case, Dr. Murray said, was made from the history of the attacks of epigastric pain, and principally from the fact that the tumor was behind the stomach. It should be noted that the urine was negative to the Cammidge test. The post-operative history was of interest, as diabetes had developed since the operation, and it was probable that chronic pancreatitis existed and perhaps had some etiological bearing on the formation of the cyst. The prognosis was fair, but if improvement did not continue, drainage of the gall-bladder might be of use, as this measure had apparently cured cases of chronic pancreatitis.

The third patient was a boy, nine years old, who was admitted to the Hudson Street Hospital on May 19, 1910, half an hour after he had been run over by a delivery wagon. On admission, there was slight shock, and upon examination the abdomen was found to be distended, rigid, tympanitic, and painful to pressure over its lower part. A small fragment of bone broken off from the crest of the ilium was easily felt. The boy was carefully watched for some hours, and as there was apparent increasing dullness in the flanks, it was deemed wise to explore the abdomen. Through a three and one-half inch incision, a little to the left of the umbilicus, the abdominal cavity was opened and explored. No rupture of the small intestine was found, but at various points, small ecchymotic areas of its wall were noticed. The mesentery was uninjured, and in the right gutter, under the liver, a small amount of free blood was sponged away.

Recovery from the operation was uneventful, and the patient was discharged about three weeks after the accident. After leaving the hospital there was loss of weight and strength, the abdomen became gradually distended, and the patient complained of a feeling of weight in the upper part of the abdominal cavity. His appetite was lost, all foods disagreed with him, and he was rapidly losing strength.

When the patient was re-admitted to the hospital, on June 25, 1910, he was emaciated and anæmic in appearance, but there was no fever nor elevation of pulse. The epigastric region was much distended, and on palpation a tense mass could be felt. It gave the impression of being cystic and extended across from

one costal margin to the other. Light percussion over the tumor was tympanitic; deep percussion revealed slight dulness. Inflation of the stomach revealed gastric tympany above, to the right of its normal situation, and in front of the tumor.

A diagnosis of pancreatic cyst was made, and the abdomen was opened through a median incision starting one inch below the ensiform and terminating at the level of the umbilicus. The stomach was found crowded somewhat to the right by a large, cystic tumor of a pearly appearance, which presented between the stomach and transverse colon. The peritoneal cavity was walled off with gauze packing, the cyst was punctured with a trocar attached to a suction apparatus, and over a quart of clear, limpid fluid was evacuated. On exploration of the cyst cavity with the finger, it was found that it was the cavity of the lesser peritoneum. Behind, the pancreas could be distinctly felt, and, apparently, it was of normal size and consistency. The cavity was drained with a rubber tube, and the abdominal wound was closed down to the point where the tube emerged. The discharge was very profuse for the first three days, necessitating frequent change of dressings. After this, it gradually diminished, patient making an uneventful recovery. When he left the hospital, in the latter part of July, there was some discharge from the sinus, but the latter healed a few weeks later, and the present condition of the patient is most satisfactory. He has gained in weight and strength, his digestion is excellent, and he is perfectly well.

This case, Dr. Murray said, was one of pseudocyst of the pancreas, due to trauma, a condition which had been so well described by Koerte. Evidently the wagon, in passing over the boy's abdomen, caused a slight laceration of the pancreas, with some hemorrhage which escaped through the foramen of Winslow, and was found in the right gutter under the liver. Owing to the escape of blood followed by pancreatic juice into the lesser cavity of the peritoneum, a mild form of peritonitis developed, with closure of the foramen of Winslow. In this way the cavity became gradually distended, and formed the tumor which was found at operation.

TUBERCULOSIS OF THE URETER.

DR. ALEXANDER B. JOHNSON showed a case of tuberculosis of the ureter in which he had removed the ureter five months after nephrectomy for tuberculosis of the kidney. The patient

was a married woman, 26 years old, a native of the United States. She was admitted to the New York Hospital on May 25, 1910, complaining of cramp-like pains in the right loin radiating downward to the bladder and perineum. She had had chills, fever, frequent and painful urination, with occasional attacks of hæmaturia. These symptoms had persisted for four months, and the pain had been severe enough to require the use of morphine.

Abdominal examination and palpation showed an enlarged, very tender, and freely movable kidney. The patient had a slight rise of temperature every evening. A cystoscopic examination, made by Dr. Whiting, showed swelling, congestion and œdema of the mucous membrane of the bladder, most marked near the right ureteral orifice. The urine from the left kidney flowed three times as rapidly as that from the right. The urine from the right kidney contained pus, blood, and albumin; that from the left was negative.

The right kidney was removed on May 29, 1910, by Dr. Eugene H. Pool. It was enlarged to about twice its normal size, and showed numerous cystic cavities containing bloody fluid and varying in size from 5 to 2 cm. in diameter. Throughout the remaining kidney substance were scattered large and small sub-maxillary tubercles. The ureteral opening from the pelvis could not be found. The patient made a rapid recovery and left the hospital apparently well.

On October 7, 1910, she was re-admitted to Dr. Johnson's service with the history that, while her general health had notably improved, she had suffered for several weeks from pain in the right groin and bladder, with fever and chilly sensations. Upon abdominal palpation, tenderness was complained of along the course of the right ureter, and it was possible to feel a cord-like mass, the size of a man's thumb, crossing the brim of the pelvis on the right side. Examination *per vaginam* showed the presence of a similar mass connected with the bladder. This mass was tender, fixed, and elastic.

A second cystoscopic examination made by Dr. Whiting showed that the bladder was normal, with the exception of a congested, swollen area 1 cm. in diameter surrounding the right ureteral orifice. A bougie introduced into the orifice of this ureter met with an obstruction 2 cm. from the outlet; no urine was obtained. Urine obtained from the left ureter was normal.

On October 8, 1910, Dr. Johnson made an incision six inches

long, above and parallel to Poupart's ligament. The muscular structures were divided, the peritoneum pushed toward the median line, and the enlarged ureter exposed. It was firmly adherent to the peritoneum, and about three-quarters of an inch in diameter at its thickest point.

The ureter was removed to a point about 1 cm. from the bladder wall, where its lumen appeared to be obliterated. The section removed was about eight inches long. It contained 35 c.c. of creamy pus, with numerous tubercles.

The patient made a good convalescence, and left the hospital on November 7, 1910. She is now in good health.

CHRONIC JAUNDICE CAUSED BY PRESSURE UPON THE DUODENUM BY A BAND.

DR. JOHNSON showed a man, 22 years old, an Italian, who had been operated upon in another hospital three months before for jaundice. At that time the condition was supposed to be due to gall-stones. No gall-stones were found, however; his gall-bladder was drained for a time, and he left the hospital after four weeks, apparently well.

He was admitted to the New York Hospital on September 8, 1910. Two weeks before that date he began to suffer from pain in the upper right quadrant of the abdomen, with fever, chills, and repeated vomiting. He had become markedly jaundiced.

When Dr. Johnson re-opened the abdomen, on September 10, 1910, firm, dense adhesions were encountered everywhere, obliterating the peritoneal cavity. The gall-bladder was exposed with some difficulty. Palpation of the common duct failed to detect the presence of a stone. The gall-bladder was opened and drained with a tube, and the rest of the wound was closed. Very little bile escaped through the tube, and during the following ten days the patient became more and more deeply jaundiced. His temperature ranged at night between 104° and 105° F.; he suffered much pain in the upper abdomen and was unable to retain food. His stools contained a very small amount of bile. On September 20 Dr. Johnson again opened the abdomen, and after a rather careful dissection, he exposed freely the pyloric end of the stomach and the descending portion of the duodenum. A very dense band of scar tissue could then be seen and felt extending horizontally across the duodenum, just below the pylorus, compressing it firmly. This band was dissected away.

While it seemed probable that the cause of the biliary obstruction had now been removed, it was thought best to open the duodenum and try to demonstrate the patency of the common duct. This was done by a vertical cut in the anterior aspect of the bowel, about an inch and a half in length. The papilla was found and a probe introduced for a short distance, and upon this probe the duct was slit up for a quarter of an inch; flexible bougies were then passed upward toward the liver, the largest size being No. 14 F. This appeared to be tightly grasped by the duct, and no larger instrument was introduced. After this dilatation, bile could be seen flowing freely into the intestine. The bowel was then closed by suture, the rubber drainage tube being allowed to remain in the gall-bladder.

Following this operation, the patient's fever and jaundice subsided, and his stools contained abundant bile. His convalescence was delayed by leakage from the wound in the duodenum, stomach contents and bile being noted in the dressings on the tenth day. This fistula persisted for a month.

The patient left the hospital on October 27, and gradually regained good health. He had, however, occasional fairly severe attacks of abdominal pain, but no jaundice.

TUBERCULOUS BURSITIS OF THE THIGH AND GROIN.

DR. JOHNSON presented a woman, 35 years old, who two years ago first noticed the presence of a small tumor in the left groin. This had slowly increased in size, and had become so large that she had difficulty in walking on account of pain.

Examination showed the presence of a rounded, tender, elastic mass which presented on the anterior and internal aspects of the thigh; its upper limit extended to the fold of the groin; its lower limit about four inches below that level. The tumor lay to the inner side of the vessels. It was difficult to make out the nature of the mass.

Dr. Johnson made a semilunar incision over the most prominent part of the tumor. Upon dissecting up a flap of skin and subcutaneous tissue, it was found that the tumor lay beneath the fascia lata and between and partly beneath the gracilis and adductor longus muscles. It was readily dissected out, and proved to be a sac with thin connective-tissue walls, about the size of a large goose egg. The contents of this sac consisted of a watery, straw-colored fluid. Behind and to the outside of the

sac another and much larger one was found lying behind the adductor longus and pectineus muscles, its superior aspect occupying the thyroid foramen. This sac was also enucleated with the hand. It was about the size of a large, closed fist, and contained thick, creamy tuberculous pus. Its walls were thick and firm. Pathological diagnosis, tuberculous bursitis. Primary union occurred in the wound, and the patient was now quite well.

HEMORRHAGIC PANCREATITIS (RECURRENT).

DR. EUGENE H. POOL presented a man, 43 years old, who was admitted to the House of Relief on October 14, 1910, in the service of Dr. Frank Hartley. He complained of severe, cramp-like pains in the epigastrium, which had begun suddenly about twenty-four hours before admission, three hours after eating, and had soon become intense and almost continuous. He felt nauseated from the onset of the attack, but had vomited only once. He had moderate diarrhoea during and previous to the attack.

He stated that in January, 1908, he had had an almost identical attack. At that time he entered the J. Hood Wright Hospital and was operated upon by Dr. Howard Collins. The operative findings were said to have been typical of acute hemorrhagic pancreatitis, fat necrosis, etc. He made a slow but complete recovery.

The patient had dysentery in 1899 after returning from Cuba. He had been a heavy drinker for years, and in recent years had suffered from morning retching. Otherwise the details of his past history were unimportant.

The main features of his physical examination were evidence of great pain and tenderness in the epigastrium, and very marked muscular rigidity in the upper part of the abdomen. There was no distention nor dulness. Patient appeared to be extremely weak; the extremities were cold; pulse 90 and feeble; temperature subnormal, 97.6°; respirations, 40 to 50. White blood-cells numbered 28,000, with 86 per cent. of polymorphonuclears.

Dr. Pool operated at once under ether anaesthesia. A median epigastric incision was made to the left of the scar of the former incision. Adhesions of omentum to the parietal peritoneum were cut between ligatures, and the stomach and transverse colon were displaced upward with some difficulty. In the space thus exposed there was a large amount of bloody fluid, which was mopped dry. The transverse mesocolon, pancreas, and neighboring struc-

tures presented as a boggy, blood-infiltrated mass, in which no anatomical features could be recognized. A rubber tissue dam was spread out underneath the region of the pancreas, with gauze packing above it, which was brought out at the lower angle of the wound. It seemed unwise to do more than this on account of the patient's extremely poor condition. An infusion was begun towards the close of the operation, which lasted about 25 minutes. Vomiting persisted for 30 hours after the operation, and delirium tremens seemed imminent on the third day. There was a bloody discharge from the wound for seven days, and for ten days after this the discharge consisted of much necrotic tissue, with small blood-clots and a thick, mucoid fluid.

Several times it was reported that the stools contained a small amount of fat. The urine was negative. Attempts to determine the character of the necrotic tissue and the presence of a ferment in the discharge were inconclusive. After the seventeenth day the discharge rapidly diminished, and by the fortieth day the wound had healed. Since then patient had been in good health.

CASES ILLUSTRATING THE USE OF THE RECTUS MUSCLE IN DIRECT INGUINAL HERNIA.

DR. WILLIAM A. DOWNES, in connection with these cases, said the use of the rectus muscle for direct hernia was not new, Bloodgood especially having recommended its use in this class of cases, and Davis, of Philadelphia, had described a procedure very similar to the one shown.

Dr. Downes said the essential features of the operation, as he had performed it in over 50 cases, were as complete removal of the sac as conditions would allow; in many cases the sac was divided into two portions by the deep epigastric vessels, one part above and external, an indirect hernia, and another below and internal, the direct portion. In these cases the vessels should always be divided, thus forming one sac. As a matter of fact, all indirect hernias should be explored by passing the finger through the neck and testing the condition of the posterior wall of the inguinal canal. Frequently, a weakness would be found which was not suspected. A frank sac might not always be present, but it was in just such cases where there was a weakness that recurrence took place, and in which the additional safeguard of rectus transplantation was indicated.

After the sac had been disposed of, the internal oblique and

transversalis were held up by a small, blunt retractor placed at the internal ring, and these muscles were followed down and in until they joined the transversalis fascia at the outer margin of the rectus. The sheath of the rectus, formed by these structures at this point, was opened, and the muscle was exposed down to its pubic attachment. Three sutures of kangaroo tendon were now taken between the outer margin of the muscle and Poupart's ligament, which had been completely freed and exposed by proper retraction. The sutures should be placed from below upward, and about one-half to three-quarters of an inch apart. A fourth suture might be necessary. After all sutures were placed, gentle traction should be made, drawing muscle and ligament well together, and while thus held by an assistant, the sutures should be tied in the order of their insertion.

In his earlier cases, Dr. Downes said, the aponeurosis of the rectus was split on its upper surface, turned down with the muscular fibres, and sutured to Poupart's ligament, but in a number of instances the lower part of the muscle was found to be so thin that this incision went through, and when the sutures were tied, a weak area, triangular in shape, was left in the muscle.

The retractor was now removed from beneath the internal oblique and transversalis muscles, and the usual Bassini operation performed from above downward, the sutures catching Poupart's ligament just superficial to and between those of the first row. The external oblique was then closed in the usual way. It would thus be seen that there were three distinct layers, and not only the weak but the often absent posterior wall of the inguinal canal had been strengthened as it could be done in no other way. The cord was always transplanted. Frequently, the cremaster muscle was so thin and frayed that it had best be cut away; at other times it was thick and strong, and it then should be included in the sutures uniting the rectus with Poupart's ligament.

All of his cases, the speaker said, had healed by primary union, and thus far the results had been uniformly good. Ten had been followed for more than one year. One case, which he showed, was operated upon in November, 1909, for double direct hernia. The patient's occupation was that of a prize fighter, and he stated that he had felt like a new man since the operation. In this case, the epigastric vessels were divided on both sides.

DR. A. V. MOSCHCOWITZ asked Dr. Downes wherein the advantage of this method of operating lay in the cure of direct

hernia? If the operator was able to bring over the conjoined tendon and suture it to Poupart's ligament, as he evidently did, wherein lay the advantage of bringing over the rectus muscle first? If the conjoined tendon could be brought over, he did not quite see what the advantage was of putting in a layer of interposed muscle.

Dr. Moschcowitz said that direct hernia was not nearly as common as the indirect, and the cases of the former that he had seen were those where the opening lay towards the median line. Another point of importance in connection with direct hernia was to do the operation *with* transplantation of the cord.

Dr. JOHNSON said that in the very cases where direct hernia occurs, the conjoined tendon was usually a very feeble structure, while the transversalis was scarcely worth mentioning at all. The very reason why this form of hernia occurred was that the internal oblique was inadequate, as had been pointed out years ago by Dr. Blake. The point where the hernia occurred was not so much outward, but close to the median line and to the spine of the pubis, and it was there that we could utilize this strong rectus muscle, whereas the other structures in these cases were hardly worth utilizing at all.

Dr. CHARLES N. DOWD said he had practised the method described by Dr. Downes in five or six cases, and had found it very practical. It certainly gave a re-inforced layer of protection, and presented great advantages in the cure of these direct hernias.

Dr. L. W. HOTCHKISS said he had used and taught essentially this method of operation in direct hernia for several years, and he thought Dr. Downes's point was well taken and a very important one. The combination of the direct with the indirect form of hernia he had found not at all uncommon. He brought over the rectus muscle and transplanted the cord in practically all old direct hernias in elderly men.

Dr. MOSCHCOWITZ said that he had not the slightest doubt that the operation, as carried out by Dr. Downes, was a good and proper one; he questioned merely the absolute necessity of the procedure. The speaker said that in order to convince himself that it did not make any essential difference whether we used any muscle at all in these operations, he had, during the past three years limited himself to bringing down the aponeurosis of the external oblique, using no muscle at all, and thus far he had never observed a recurrence in any of the cases where this was done.

DR. PARKER SYMS said he would like to mention what to him, at least, was a new factor in the production of direct hernia. He recently saw a Russian who had a direct hernia which had been purposely produced by a surgeon, the object being to render the subject unfit for military service. The hernia had been produced by the finger invaginating the scrotum, just as one examines an inguinal hernia. The finger had forced a direct opening just below the external ring.

DR. DOWNES, in closing, said he was convinced, with Dr. Johnson, that the internal oblique and transversalis were of little or no service in the closure of this form of hernia. The indication for the use of the rectus muscle was the weakness or absence of the combined lower portion of the internal oblique and transversalis; that is, when the posterior wall of the inguinal canal was wanting. The best illustration of the fact that the usual methods of dealing with this type of hernia were insufficient was the number of recurrences that was seen. Personally, he had operated on probably twenty such cases during the past year.

FRACTURE OF BOTH BONES OF FOREARM; BONE PLATING.

DR. WILLIAM A. DOWNES presented a man, 35 years old, whose arm was caught in a belting six weeks previous to coming under his observation on December 27, 1910. There was marked over-riding of both bones, with moderate side union of the ulna; none of the radius. A four-inch incision was made on the ulnar and radial sides of the posterior surfaces, and Lane bone plates applied. More than an inch had to be removed from each bone before they could be properly adjusted. Very good position was finally obtained, as shown by X-ray. Dr. Downes said the patient was shown at this time, four weeks after the operation, in order to call attention to the value of the plates in this class of cases.

PERFORATED ULCER OF THE JEJUNUM SEVEN YEARS AFTER ROUX GASTRO-ENTEROSTOMY.

DR. JAMES M. HITZROT presented a man, 26 years old, who was admitted to the New York Hospital on August 26, 1910, complaining of acute pain in the abdomen of two days' duration. The pain, which was at first diffuse, subsequently became localized in the right lower quadrant. The patient had vomited once about eight hours before admission. His temperature was 101°; pulse 140, small and easily compressible. The abdomen

was slightly distended, and no respiratory movements were present. In the midline, above the navel, there was the scar of a previous operation, and about the centre of this there was a slight hernial protrusion which was reducible. The abdomen was rigid and tender, and there was definite muscular spasm, all the symptoms being most marked in the right lower quadrant. There was dulness in both flanks, the mobility of which was not determined owing to the severe pain complained of by the patient. A blood examination showed 18,000 leucocytes, with 80 per cent. of polymorphonuclears.

Inability to speak the patient's language and the definite exaggeration of the signs in the right lower quadrant led Dr. Hitzrot to make the usual appendix incision. Upon opening the peritoneum, an odorless, mucoid fluid gushed out. The appendix was found to be normal. Exploration of the abdominal cavity through the appendix wound showed an abnormality of the intestines in the upper abdomen. A second incision was made through the old scar, exposing the scar of a healed ulcer on the anterior aspect of the stomach, about 1 cm. from the duodenum. The omentum and transverse colon were then drawn out of the abdomen, revealing a Roux gastro-enterostomy, with a perforation in the jejunum on its anterior surface just distal to the line of suture to the stomach, through which intestinal contents oozed. The perforation was closed by a purse-string silk suture, and the line of closure reinforced by a few plain catgut Lembert sutures. The peritoneal exudate was then sucked out and the upper wound closed in layers without drainage. A drain was placed in the pelvis through the appendix cut, which was then closed in the ordinary manner.

The patient made an uneventful recovery, excepting for a right-sided pleurisy, which developed on the fourth day. He was discharged on the twenty-first day, with the wounds healed. It was subsequently learned through an interpreter that the patient was operated on seven years ago in Santiago, Spain, for "dilatation of the stomach."

DR. MORRIS, discussing Dr. Hitzrot's case of perforating ulcer of the jejunum, said that if the ulcer was the result of compression anæmia due to angulation of the gut, it was a comparatively simple matter for explanation; if, on the other hand, we had to deal with an ulcer of the jejunum occurring such a long time after an operation on the stomach by which the gastric contents

had been circuited, that factor might have some bearing upon the etiology of perforating ulcer. It was in line with the idea that he may have direct acid injury of mucosa. It is probable that acid irritation leads to submucous infiltration, and the tissues distended with interstitial infiltrates are temporarily disabled and exposed to digestive and bacterial attack. Such cases are probably less frequent in occurrence than the one due to toxic injury of terminal arteries of the region, but the occurrence of such a jejunal ulcer as Dr. Hitzrot described was significant, and had a meaning which we must not neglect to read.

DR. HITZROT, replying to Dr. Morris, said there was no angulation of the gut in the case he had shown. The perforation lay perfectly free, and the old line of suture was entirely intact. The perforation was on the anterior surface of the jejunum, and there was quite a free space between the line of suture and the perforation. The parts bled freely on incision, and there were no indications of local anæmia.

ABSCESS OF THE FOREARM DUE TO THE GLANDERS BACILLUS.

DR. HITZROT presented a stableman, 28 years old, who came to the Out-Patient Department of the New York Hospital in August, 1910, complaining of an abscess of the left forearm. The swelling had appeared about four weeks before, and had increased slowly in size. It had caused him practically no pain, but recently had become quite soft. No other swellings; no cough; no coryza nor nasal discharge. There were occasional night-sweats.

Examination showed an abscess over the radial aspect of the upper third of the left forearm, over which the skin was slightly reddened. There was no surrounding œdema. The abscess fluctuated and was non-painful. There were no enlarged epitrochlear or axillary glands. There were no abscesses elsewhere, and a general examination of the patient was negative.

Owing to the man's occupation and the curious appearance of the abscess, it was aspirated, and some of the pus, which was thick and yellow in character, was injected into a male guinea pig; some was also planted on culture media, and a smear was also made. The smear showed large numbers of mononuclear cells, with a few broken-down polynuclears; no bacilli. The guinea pig developed a double orchitis, and the culture gave the *Bacillus mallei* in pure culture.

Operation: Under gas, the summit of the abscess was excised, and the abscess was found to be in the deep fascia overlying the muscles, but not extending below it. The cavity was cauterized with pure phenol and tincture of iodine, and packed with gauze saturated with a 1 per cent. solution of iodine in glycerine. The wound healed in the course of two months; the patient had since had no further symptoms, and was now entirely well.

Subsequent cultures and animal inoculation gave the same result as that found at first.

(Bacteriological and animal experiments were made by Drs. Elser and Symmers, to whom Dr. Hitzrot acknowledged his indebtedness for the reports above.)

OSTEOMYELITIS OF THE RADIUS; POST-TYPHOID.

DR. HITZROT presented a young man of nineteen who was admitted to the New York Hospital, in the service of Dr. Frank Hartley, on October 19, 1910, with acute appendicitis, for which he was operated upon and a large appendix filled with pus was removed. His recovery was uneventful. He gave a history of typhoid fever one year ago, and three months before his attack of appendicitis he noticed a swelling over the lower end of the right radius, which had steadily but very slowly increased in size. It had caused him very little pain, and his medical attendant had advised him to let it alone. There was no history of injury to the arm.

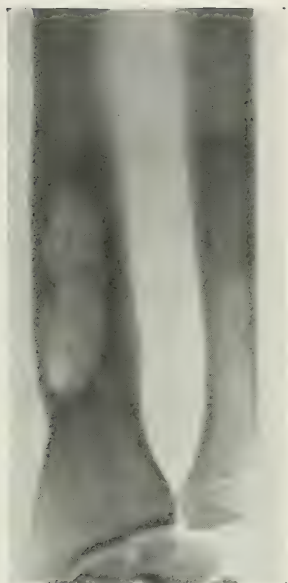
Examination showed a swelling of the right radius about an inch and three-quarters above the styloid process. It was very hard, not tender, and seemed to involve the entire thickness of the bone (Fig. 1).

Operation, November 2, 1910: Through a palmar incision the bone was exposed and the periosteum elevated, revealing a thin shell of bone. At one point, reddish, gelatinous material had broken through the bone. The outer shell of the bone was cut away with the rongeur, exposing a mass of reddish, yellow, gelatinous material which was very friable, but which stripped away from the bone quite readily, leaving a clean, egg-shaped cavity. This was bevelled down and sterilized by the application of tincture of iodine, and the wound was closed. It healed uneventfully in the course of ten days.

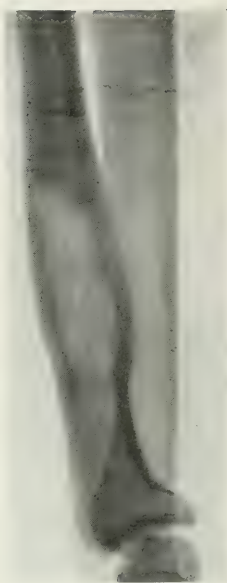
Pathological report, by Dr. Elser: The organism isolated from the abscess, tested on different media, proved to be a typical

FIG. 1.

A.



B.



Post-typhoidal abscess of radius. A, anterior view; B, lateral view

typhoid bacillus. Agglutination tests with the patient's blood, microscopically and macroscopically, gave a positive typhoid reaction.

TECHNIC OF THE OPERATIVE TREATMENT OF APPENDICITIS, WITH ESPECIAL REFERENCE TO THE TREATMENT OF PERITONITIS.

DR. ALEXANDER B. JOHNSON read a paper with the above title, for which see page 525.

DR. MURRAY, speaking of other conditions to which the method of aspirating the peritoneal fluids described by Dr. Johnson could be adapted, said that it had been used to keep the mouth and pharynx free from mucus during anæsthesia. It could also be employed to empty an ovarian cyst without any leakage of the cyst contents into the peritoneal cavity, and in case of papillary cysts the prevention of infection of the peritoneum by cyst contents is of vital importance. In operations on the gall-bladder and the urinary bladder, the suction apparatus is very satisfactory in keeping the field of operation dry.

DR. HITZROT presented a number of cases of appendicitis with diffuse peritoneal exudate in which the apparatus for cleansing the peritoneal cavity, as demonstrated by Dr. Johnson, had been employed. In all of these cases, free fluid, which was cloudy or frankly purulent, gushed out on opening the peritoneal cavity. With the sucker, as described by Dr. Johnson, the fluid was rapidly aspirated, the chief aim being to cleanse the peritoneal cavity with as little delay and traumatism as possible. In fourteen cases in the service of Dr. Hartley treated by this method in which the peritoneal exudate was examined, four gave the colon bacillus, two the *Staphylococcus aureus*, and eight were sterile. In all of these cases the operation was done as soon as the patients entered the hospital; in five, this was from 36 to 40 hours after the onset of the disease; in six it was from 48 to 60 hours, and in three it was three days.

DR. JOHNSON said that Dr. Frank Hartley had done more to develop this apparatus and perfect its use than any one else. It was originally devised by Drs. J. H. Kenyon and Eugene Pool.

DR. HARTLEY said that some years ago an article appeared in one of the French journals describing a method of employing suction for the purpose of keeping the throat clean during anæsthesia. The speaker said the method attracted the attention of Dr. James H. Kenyon and himself, and a month or two later with the help of a small pump they fitted up this apparatus, which

could be used for various purposes other than the removal of peritoneal exudates, to which Dr. Johnson had limited his remarks. It could be used for the removal of the contents of echinococcus cysts of the liver, and for draining the gall or urinary bladder. By this method the drainage was so perfect that the skin was kept dry, avoiding irritation and secondary eczema. Its adaptability for the purpose of removing mucus from the upper air-passages during anæsthesia had already been referred to, and it was also useful following operations about the throat, where it lessened the danger of aspiration pneumonia.

DR. GEORGE E. BREWER said he wished to testify to the value of this apparatus. About a year ago, Dr. Kenyon had introduced a similar one at Roosevelt Hospital, connecting it with an ordinary water main to secure the necessary suction force. The results obtained with it had been very satisfactory, although thus far they had not employed it in cases of general peritonitis, but he intended to do so. They had employed it in ordinary gall-bladder drainage and in the removal of cystic exudates, and it had also been found very useful for the removal of blood in operations on the Gasserian ganglion.

GAS CYSTS OF THE INTESTINE.

DR. P. R. TURNURE showed a specimen of this condition. The specimen consisted of about two feet of small gut taken near the junction of the jejunum and ileum. The patient was a Chinaman, 57 years old, a laundryman by trade, who was admitted to Dr. Johnson's service at the House of Relief on January 18, 1911. He gave a history of indefinite abdominal pain of several months' duration, but at no time was he obliged to give up his occupation. About eight o'clock on the day of admission he was suddenly seized with cramp-like pains in the epigastric region; he vomited and the abdomen rapidly began to swell. He was brought to the hospital in the ambulance at 3 P.M., and upon admission he showed all the symptoms of a perforation of either the stomach or duodenum, and an immediate operation was decided on.

The usual incision was made, and upon opening the peritoneum a large quantity of gas escaped, and the entire cavity was found to be distended with a serosanguineous fluid, which was almost clear. Over a gallon and a half of this fluid was removed by aspiration. The specimen shown by Dr. Turnure presented itself in the wound. At the time of operation, the hundreds of cysts

which are plainly apparent at the present time were at least three or four times their present size, and although many can still be seen to be pediculated, a far greater number were so attached at that time. When punctured, these cysts promptly collapsed, with the escape of air. The rest of the peritoneum was irregularly injected, opaque, and covered by a thin, slightly reddish, fibrinous exudate. As the condition of the patient was very low, no more extended investigation was possible, and the wound was closed. Death occurred at eleven o'clock that night.

At the autopsy, a perforated gastric ulcer was found in the lesser curvature near the pyloric opening. The stomach was very adherent to the gall-bladder, and the perforation was just to the inner side of this mass.

Bouillon cultures from the abdominal fluid showed several varieties of bacilli. Agar plates showed three varieties of colonies, namely, *Proteus*, *Bacillus lactis aërogenes* and *B. coli communis*. Anaërobic cultures taken from the cysts in the peritoneal cavity showed innumerable large Gram positive bacilli, which failed to grow under aërobic conditions. The organism found, therefore, belonged to the anaërobic group. It was, however, somewhat smaller than the *Bacillus lactis aërogenes* of Welch.

Pathological examination (preliminary report): Just outside of the longitudinal muscular coat (in the section) there was a conglomeration of cystic spaces, varying in size from $\frac{1}{4}$ mm. or smaller to about 4 mm. in their long diameter. These spaces were irregularly ovoid, separated in places by merely a thin connective-tissue wall, in other places by larger areas of tissue. The walls were composed in the main of longitudinally placed connective fibrils, the lining of the cysts showing a single layer of flattened endothelial-like cells. Although for the most part lying outside of and partly in the longitudinal muscular coat, the cysts had penetrated the circular layer in places, encroaching upon the mucosa. The solid connective-tissue areas between some of the compartments showed an active proliferation of fixed connective-tissue elements, and a moderate infiltration with lymphoid cells. It seemed that the spaces above described might have some relationship to the lymphatics, inasmuch as some of them could be traced into enlarged channels not unlike lymph spaces.

These preliminary examinations, Dr. Turnure said, would seem to justify the belief that the condition was that known as "gas cysts of the intestine."

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held December 5, 1910.

The President, DR. R. G. LeCONTE, in the Chair.

VOLKMANN'S ISCHÆMIC PARALYSIS.

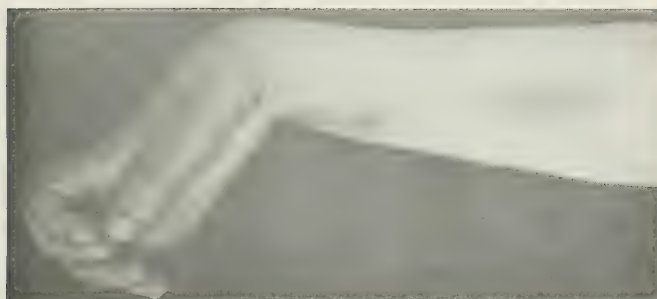
DR. JOHN H. JOPSON presented a boy of eight years, who was brought to him about three weeks after sustaining a fracture of both bones of the forearm, which had been treated by the use of anteroposterior splints. When the splints were removed, about ten days after the accident, pressure sloughs were found on both the flexor and extensor surfaces of the forearm. Contracture of the fingers and hand quickly followed. The contracture was typical of Volkmann's ischæmic paralysis, viz., a fixation of the part due to shortening of the flexor tendons of the fingers. There were unhealed ulcers on the flexor and extensor surfaces. Two months later the boy was admitted to the Presbyterian Hospital.

On examination of the arm, the ulcerations were found to be healed. That on the flexor surface was adherent to the subcutaneous tissues. The hand was held in a position of flexion and pronation, the fingers extended and abducted (Fig. 1). The hand could be moved about 30°. When the fullest extension possible was obtained, the fingers were flexed; when the hand was flexed, they were extended. There was anæsthesia over the distribution of the ulnar nerve in the hand.

Massage and passive motion were used for the next two months without much improvement.

Operation five months after original injury. An incision was made at the site of the scar on the flexor surface of the forearm, four inches long. The tissues beneath were adherent and were separated. The muscles were yellow in color and in a state of degeneration, brittle, and fibroid. Both the median

FIG. 1.



Volkmann's ischæmic paralysis.

and ulnar nerves were imbedded in fibrous tissue, and adherent, thinned out, and atrophied as if by pressure, for a considerable distance in the lower third of the forearm, but above this point abruptly becoming of normal appearance.

Muscles and nerves were dissected apart, and myotomy and lengthening of the flexor sublimis digitorum and palmaris longus were practised. The flexor profundus was not lengthened, although contracted, this being deferred for a second operation, if necessary. The forearm and hand were dressed upon a palmar splint.

This operation has been followed by some improvement. There is an increased range of motion; the area of anæsthesia is lessening, and further improvement is hoped for, especially as the condition in which the nerves were found was one which would promise a gradual improvement.

Dr. Jopson added that both the etiology and treatment of this condition have been the subject of considerable discussion, and the valuable paper of John Jenks Thomas, in the *ANNALS OF SURGERY* for March, 1909, contains an excellent review of the subject from these stand-points. The principal theories advanced as to the causation are obstruction to the arterial supply, interference with the return venous circulation, and compression and injury of the nerves.

The latter is looked upon by some writers, including Thomas, as a secondary and contributing but not a necessary factor in its causation. In over one-half of the cases symptoms of nerve involvement were present. Tight bandaging is not always a factor in the etiology. Whatever the cause, the changes in the muscles involved are very striking, both macroscopically and microscopically. They are found to be yellow in color, hard, contracted, the nuclei and transverse striations lost, and the connective-tissue elements increased.

Treatment is oftentimes unsatisfactory. Operative measures include lengthening of the contracted muscles by plastic operations on the tendons or, better still, upon the muscles, freeing of the nerves, and shortening of the bones by resection.

DR. GWILYM G. DAVIS said that he had seen some of these cases. Personally he was inclined to think the nerves play a very considerable part in the deformity produced. In the picture which Dr. Jopson had passed around the position assumed by the

hand was almost absolutely that of ulnar paralysis. The extension of the proximal phalanges and the contraction of the distal and middle ones was most typical of that which resulted when the ulnar nerve is injured. It is believed that the injury of the median nerve does not cause so much trouble, because its distribution in the hand, as far as motor influence goes, is comparatively slight, therefore when the two nerves are injured, as was apparently the case in Dr. Jopson's patient, the contraction of the muscles supplied by the ulnar nerve overshadows that of the muscles supplied by the median nerve, and the consequence is the typical contracture of Duchenne. On operation the muscles are found more or less bound together and the tendons to the nerves.

As regards the treatment, the most severe cases are at present almost hopeless, but there are a number of others not of the highest grade of severity for which very much can be done, and the line of treatment is perfectly clear. In the first place, one ought to lay back such a flap as will give proper access, and then follow the ulnar and median nerves down through the cicatrix, if necessary deliberately resecting them and uniting the ends again. As regards the tendons, they should be separated and lengthened in the manner followed by Dr. Jopson. Advantage should be taken of the fatty tissue to slip it in between the tendons, and also the use of Cargile membrane may be resorted to.

The same condition identically is produced by injuries of the forearm, the result of machinery accidents, and the same treatment is applicable.

DR. JAMES K. YOUNG said that something should be said of the manipulation in these cases in addition to the operative methods. After the operation it is advisable to manipulate them after the method of Robert Jones, of Liverpool. He showed in Washington this method, manipulating first the hand, holding the arm firm, and he claimed very good results. In addition to the operative treatment such manipulation of the parts will very much improve the condition.

DR. JOHN H. GIBBON remarked regarding the technic of anastomosis of tendons and nerves, calling attention to a method to prevent the fixation of the nerve in scar tissue. It is known that Cargile membrane and other kinds of material are used to prevent the fixation at the point of anastomosis, but it occurred

to him in making an incision to take one of the big superficial veins and make a cuff from it. He therefore resected about an inch and a half from one of the large veins, put it in salt solution until ready for it, then, resecting the nerve, slipped the cuff up on one end, brought the other end of the nerve up and sutured it, then slipped the cuff over the point of anastomosis. Although the result obtained in this case (one of long standing) was unsatisfactory, he believed the use of the superficial veins in this way would be a satisfactory method of preventing adhesions, which are so apt to occur at the line of anastomosis.

After performing this operation, he learned that some one else had thought of this method, although he had never heard of it.

DR. J. EDWIN SWEET called attention to a method of attaining the result desired by Dr. Gibbon—the use of veins or arteries of animals, stretched over glass rods and hardened in formalin, the formalin removed by washing in water, and the preparation then boiled. This method, suggested by Foramitti, has two advantages over the use of a fresh superficial vein: the one, that different sizes and lengths can be prepared and kept on hand; the other, that the tube thus prepared resists absorption longer than the fresh tissue, and would be less likely to become adherent in either the nerve or the surrounding structures.

FRACTURES OF THE PATELLA.

DR. E. G. ALEXANDER read a paper with this title, for which see page 508.

DR. WALTER G. ELMER, with regard to the statistical showing that fractures of the patella were slightly more numerous in the left knee, said that in the Hospital for Ruptured and Crippled Children in a series of several thousand cases of tuberculosis in which traumatism was supposed to play a part, 55 per cent. had the right knee affected; another series was slightly in favor of the left knee. In a recent medicolegal case, the counsel for the defendant and the witnesses on that side took the stand that the injury was greatly in favor of the right knee. These figures are valuable as showing that such could not be said to be the case, but that one knee was as likely to be the seat of injury as the other.

DR. JOHN B. DEEVER said that his experience in the treatment of fracture of the patella agrees with the views expressed by

Dr. Alexander. For the last two years he had adopted this method of treatment, and the results obtained had been better and the length of time in bringing about the result much shorter. Formerly it was his practice to put the knee up in plaster after wiring, taking the case off in ten days or two weeks, after the removal of which passive motion was cautiously made. He no longer uses plaster but treats as above stated.

DR. JOHN H. GIBBON said that in dealing with this subject Dr. Alexander had looked at it from a distinctly modern point of view. He had said nothing about the older ways of treatment, either the subcutaneous suture or the straight incision. He believed this is the way it should be looked at. The time has passed when, if the environment for operation is proper, the patient should be treated with a splint. Of course care must be exercised in the choice of cases, for it is in the non-observance of this precaution that the mortality comes in. It is plain that alcoholics, syphilitics, and others offering general contraindication to operation should be excluded.

With regard to points of personal technic, his preference is for an incision going below the fracture at least an inch, for then in case infection should occur, it is not immediately over the line of fracture, and moreover if a refracture occurs, it is not a compound one. He had only used a straight incision once and a silver wire suture but once. He was very much impressed with Dr. Blake's article of some years ago on this subject, which emphasized the fact that the rupture of the lateral ligaments was often the most important part of the lesion, from a pathological point of view certainly one of the most important, and should therefore receive particular attention. He suggested suture of the lateral ligament and suture of the ligamentum patellæ without suture of the patella itself. Dr. Gibbon had done this in all his cases recently. The silver wire suture will not prevent a patella from breaking if it is going to break after a number of months. It is, however, the most aseptic suture that can be used. He sutured only the lateral ligament and the ligament over the patella. The mere fact that Dr. Alexander says refracture occurs late, usually after the eighth week, is against the use of non-absorbable sutures. Although in his last few cases he had used no drainage, he believed it to be a good method not to put the sutures in too close or too tight—to allow a certain amount of drainage in this manner.

Regarding the splint, after learning from Dr. Alexander what he had been doing, in his last case he took the splint off the second day, but the patient wished it replaced because he felt more comfortable with than without it.

If the fragments are exposed and the fibrous tissue is taken away, perfect bony union will result, and there is no necessity for keeping splints on for months. Early motion is the secret of the ultimate success in these cases. Those cases in which it is not employed ultimately get the same result but not so quickly.

DR. HARRY C. DEEVER said that the most important point in Dr. Alexander's paper was the after-treatment. He had not used the plaster case for a fracture of the patella for six years, nothing but silver wire. This fixes the fragment and makes it possible to begin passive movements early, often at the end of the seventh day. It is his rule to make general passive motion with light massage. These cases were able to get out of bed at the end of eighteen days and to flex their legs to a right angle shortly afterwards, and were discharged in four weeks.

He had had five cases in his private practice, and at the end of five weeks he considered each patient practically well. He would not advise flexing of the knee very strongly at an early date without suture of the fragments with silver wire.

DR. GEORGE G. ROSS had had one unfortunate experience so far as the incision for operation is concerned. He had always used the straight incision following Dr. Deaver's practice, but after hearing a discussion recommending the horseshoe incision, he had a patient, a stout woman, at the Germantown Hospital, upon whom he made a big wide horseshoe incision and wired the patella. On the fifth or sixth day gangrene of the flap developed, with infection of the knee-joint, and subsequent death of the patient. He therefore became a little skeptical regarding the propriety of this incision. He still believed the straight incision gives ample room and does not jeopardize the blood supply of the superficial fascia.

DR. JOHN H. JOPSON said that there was one point which had not been brought out with regard to the use of silver wire, which he thought to be of importance. Its use requires a drilling of the bone, which suture of the capsule does not. He formerly practised suture of the capsule alone, but in his recent cases he had drilled the fragments and used silver wire, as it seemed to

him such treatment might stimulate the osteogenetic function of the bone, even as in ununited fractures.

DR. GEORGE P. MÜLLER reported a case of recurrent bilateral fractures of the patella; the patient was shown to the Clinical Surgical Society recently. The left patella was first fractured in November, 1906, and was wired with silver wire in the usual manner; in January, 1907, a refracture of the patella occurred, and it was again wired. In April, 1907, as a result of a misstep, the patient refractured the patella again and this time it was fastened with chromic gut and has since remained united. In February, 1910, he fractured the right patella and on the ninth day after the accident this was sutured with chromic catgut and has since remained united. The patient stated that in 1906, at the time of his first fracture, his brother was operated on in the German Hospital with a fracture of the right patella which was refractured in 1909.

Dr. Müller had also seen a fracture of the patella caused by the kick of a horse, in which the lower half inch of the bone was fractured, without, as far as he was able to see, opening the joint. The fragments were in fairly good position, the lower end being tilted somewhat backward, but owing to the fact that the patient was very insistent that he should be able to ride horseback without trouble in the future, he advised operation and fastened the fragments with chromic gut. The patient was placed on a posterior splint for three or four days, a plaster cast was then applied, and on the tenth day he was allowed to walk on crutches. The cast was removed three weeks after operation and the patient allowed to walk, but he complained of inability to raise the foot and toe-drag, and upon examination he was found to be suffering from paralysis of the external popliteal nerve. The case was perfectly fitting and properly padded, and accordingly the speaker believed that the nerve was injured at the time of the accident with the kick of the horse.

In addition to the possibility of infection to the joint if the skin incision is placed immediately over the line of operation, as has been mentioned, it should be added that the scar in the skin is liable to adhere to the scar in the fascia and cause more or less trouble. A wait of two weeks at least should be observed before attempting any motion. It has been emphasized that the most important part of the operation is the suture in the torn aponeurosis and as fascial tissues are not very well vascularized they

should be given time to firmly unite. One does not, as a rule, allow patients operated upon for hernia to go about until the second week, and yet as a matter of fact there is less strain in these cases than in the flexion and extension of the knee-joint. If the torn aponeurosis is carefully and accurately brought together, it does not matter whether one uses silver wire, copper wire, or catgut in the patella, or whether one does not drill the patella but simply uses the mattress sutures of Blake or the circumferential suture. Personally, he preferred to drill the patella, for the reason mentioned by Dr. Jopson, *i.e.*, that it may have some influence in promoting bony union. The majority of surgeons have found silver wire unnecessary, but if an operator gets good results with silver wire he should use it.

DR. JOHN H. GIBBON remarked with regard to the horseshoe incision, that in all his early cases where he used the horseshoe-shaped incision he had no sloughing, but he realized it was wrong, and since then his incision had been more semilunar. He intended, when speaking before, to refer to a case of peroneal palsy, which he was sure was due to the splint. The patient had had no plaster cast, he was a very thin man; he complained of great pain over the peroneal nerve. When the splint was removed he had toe-drop, from which he very slowly recovered.

DR. A. P. C. ASHHURST said that if it was desired to get patients walking by the fourteenth day it was well to use silver wire, as union cannot be firm then. On the other hand, if they can wear a removable plaster cast, and have massage by an adequate masseur, with passive motion, it is sufficient to use chromic catgut for sutures.

A second point is that among 49 operations there were two deaths, a fact which should not be overlooked. These operations were done in one of the best hospitals, with the best surgeons and best assistants and nurses. Within the last few weeks there has been reported from Boston a series of arthrotomies for fatty tumors of the knee-joint. The mortality from infection was about 4 per cent. Lucas-Championnière, who despises asepsis, swabs out his knee-joints with carbolic acid, and claims to have done more than 80 operations for fracture of the patella without a single death. Perhaps, therefore, the aseptic is not so good as the antiseptic method.

DR. LEWIS W. STEINBACH exhibited a patient operated upon for fracture of the patella who was operated upon six weeks

before, four days after her admission to the Polyclinic Hospital. The large effusion of blood into the joint was washed out, the edges of the lacerated tendon and of the ligaments were trimmed, then the widely separated fragments of the transversely fractured patella were brought together through the fascia anteriorly and laterally of the patella. The joint was fixed with a thin silicate of soda dressing re-enforced by a posterior thin splint of wood, and then interrupted catgut sutures for the integument.

After 39 days spent in bed, the splint was removed. The bone was firmly united as shown by the skiagraph, the sutures were absorbed, and the joint had a fair degree of free motion. Patient can now walk with the aid of crutches, and it is reasonable to expect that she will soon possess normal use of the extremity.

DR. EMORY G. ALEXANDER (in closing) said, with regard to the mortality, that although the two deaths make a large percentage in this series, he felt that with the great work being done by Dr. Murphy on the knee-joint, and the advance made by English surgeons, the technic is bound to improve, and that with these improvements will come a decrease in the mortality rate.

As far as drainage is concerned, he did not advocate it as a routine measure, but occasionally there will form an extra-capsular collection due to oozing which must be removed. As to the comfort of the splint, with his patients it has always been the opposite, they saying that the pillow is much more comfortable as it allows of freer movement. There is a certain degree of motion of the knee, about 5° or 10° , which can be gradually produced without using the patella at all, and this is the motion advocated for the first few days, not forcibly flexing the knee. The majority of refractures occur after the eighth week, a point which shows the value of silver wire suture.

THE OPEN TREATMENT OF FRACTURES.

DR. EDWARD MARTIN made some remarks upon this subject.

FRACTURES OF THE SHAFT OF THE FEMUR WITH MARKED DISPLACEMENT.

DR. RICHARD H. HARTE read a paper with this title, for which see page 499.

DR. JAMES K. YOUNG said that in the treatment of vicious and ununited fractures Lambott's method is an improvement over

the Parkhill method. It consists in the use of screws, which are inserted directly in the bone without the use of the drill. The screws are drill pointed. The fracture is held in place with special forceps, by which they can be placed in better position, the apparatus held together with a part outside the soft parts, and, as has been demonstrated by Dr. Wills of Los Angeles, Dr. Robertson of Warren, Pa., and others, the fractures may be accurately set and held during union. After the apparatus has been in place for a time the screws may be readily removed by means of a key.

DR. GWILYM G. DAVIS said, relative to the method of approximation, that plates alone do not play such a very large part in the approximations of these fractures. In a bone which has big ends and is small in the middle, the ends are cancellous and the shaft is compact. A fracture of the ends is almost always transverse, and therefore the displacement is not great and the necessity of marked fixation at the ends does not exist. But in fractures of the shaft it is a different proposition. Compact bone is to be dealt with, and usually a fracture through compact tissue is oblique. In case of a transverse fracture in the shaft, a medullary splint should be used as Murphy has done. As regards the method of separating the fragments, it can be done by bending them up, and the splint can be sprung into place. In fractures of the shaft of the femur one cannot put on plates strong enough to hold them without the aid of outside force. Here a plaster-of-Paris bandage or outside splints are strongly indicated.

DR. JOHN B. ROBERTS said that the speakers seemed to be more sure of the reliability of measurements of the lower extremities after fracture than he was. A good many years ago he and others measured the bare bones of the lower extremities, and found that in limbs never subjected to fracture there was a marked difference between uninjured femurs and tibiae of the same individual. With even a considerable difference in the length of the lower legs, whether it be in the femur or in the tibia, the individual may walk with very little limp. Personally he paid very little attention to measurement of the legs after fracture of the thigh, but depended upon his eye as to the approximate amount of shortening, when he had the patient lying in bed with the pelvis straight. Although he used X-ray pictures for confirming the clinical examination, he realized that they may be very

deceptive, and should never be used in court without the recognition by all parties that an expert radiographer may make very deceptive pictures. Such deceptive pictures are very likely to be made, unless the man who takes them knows the anatomy of the region and the probable site of the fracture before the exposure to the X-ray is made and takes plates in two planes.

Nature approximates symmetry in the skeleton, but hardly ever reaches it. X-ray plates are an assistance in surgical work, but the results must be checked up by clinical examination, by inspection, palpation, etc. He had long advocated the open treatment of fractures under special circumstances. He was inclined to believe, however, that it is by no means true that the majority of fractures should be treated by open method. Many fractures of the femur, in addition to permanent traction to overcome shortening, need lateral support by plaster-of-Paris or other splints. The cases which are particularly likely to require incision and open treatment are the fractures near the junction of the upper and middle third of the femur, where eversion and flexion at the hip-joint are liable to occur from the action of the psoas and iliacus muscles.

He had noticed in this discussion that the word plaster "cast" has been used a good deal as a method of treating fractures. It is rather odd that surgeons are very apt to use this improper term. The encasements which are often used in fractures of long bones should never be called "casts." They are not casts. They are really moulds. A better term instead of plaster cast is gypsum encasement or gypsum splint.

DR. GEORGE E. PFAHLER presented a skiagraph made two weeks before, showing the remarkable power of nature to unite fractures. In this instance, the bones overlapped about one inch, and even then the sides of the two fragments were about half an inch apart. Nature has bridged this gap. When sending patients for examination, in dressings, the surgeon should mark on the dressings approximately the location of the fracture, so as to be able to bring the central ray over the line of fracture. To determine the position of the fragments stereoscopic plates should be made, or two plates should be made at right angles to each other. When this work is accurately done and properly interpreted there can be no error.

DR. A. P. C. ASHHURST said that the enthusiastic Mr. Lane

and some of his colleagues in England seem to think that the results without operation are intolerable. Dr. Harte and Dr. Martin, however, believe that certain cases do very well without operation, and recommend operation only in certain selected cases. Two years ago with the aid of the interne at the Episcopal Hospital, Dr. Ashhurst traced six cases of fracture of the femur, including forty of the shaft, and they found that 60 per cent. of the fractures of the shaft got a perfect result, while 32.5 per cent. more, making 90 per cent. in all, had no disability other than a slight limp. It seemed to him that those who advocate operation in all cases might at least publish the results of operative treatment, and let it be seen if in as large a series of cases as excellent results as these can be obtained.

DR. RICHARD H. HARTE (in closing) said that he agreed with all the gentlemen who had spoken in discussing these papers, but he would like to ask why is it that in all cases of fracture of the thigh Dr. Roberts has shortening? Is the broken leg always the short leg? Of course it is known that there is a certain amount of asymmetry in the results, but the man who treats a broken thigh without careful and accurate measurements is not giving his patient the best chance for good results.

With regard to broken plates, the trouble is that the plates ordinarily used are tempered too high, for if properly tempered and made of good steel it should be possible to bend them double and back again without breaking them. The old silver plates were far too easily bent and offered no support whatever.

Dr. Ashhurst speaks of a perfect result. What is meant by this term? Dr. Harte's idea of it is a limb that is perfectly straight, the patient walking without any limp, and no irregularity to be detected in the measurements. These are difficult to obtain.

He emphasized that he did not advocate that every fracture of the thigh should be opened and plated, but he did think this procedure to be indicated in cases where there is difficulty in keeping the fragments in position.

The mortality in these accidents should not be as great as they are in opening and wiring the patella, because in this latter operation there are two complicating conditions, a little bone to work on, and an opening into the joint in the body which is least calculated to take care of itself in infection.

CORRESPONDENCE.

CHOLELITHIASIS—FOURTEEN THOUSAND CALCULI REMOVED AT OPERATION.

WITH a view of adding to the literature of gall-stone surgery, the following case is reported, believing that the very unusual number of stones found fully justifies its presentation.

The patient was an unmarried woman, aged 52 years, who was referred to me through the kindness of Dr. George F. Simpson. Her family and personal history were negative.

Eighteen years ago she first experienced epigastric pain and vomiting. Pain came suddenly and disappeared suddenly. No further trouble for months. Then renewed attack with moderate pain and nausea but no vomiting. About a year thereafter a third attack occurred similar to the preceding. Then followed a period of quiescence lasting four or five years. After this attacks recurred about every six months. About eight years ago patient began having attacks every month, and noticed that there was a tendency for them to increase in severity, hold on longer, and return more frequently. At times they would continue throughout the night. Recently the attacks increased decidedly in frequency and severity. Nearly always vomited. No jaundice at any time. Marked chronic constipation. Pain at the ensiform cartilage, or to the right, and when it radiated it would be around the right rib toward the inferior scapular angle. During the last four years she lost 50 pounds in weight.

Operation: In the presence of Dr. Jacob Weber, Dr. Paul H. Greenleaf, of Lexington, Illinois, and with the assistance of Dr. George F. Simpson, the operation was performed at St. Mary and Elizabeth Hospital. An attempt to aspirate the bile by means of a trocar was made without success. Upon withdrawing the trocar, it was found to be clogged with a number of small stones. The appearance of the gall-bladder being perfectly symmetrical, it was not suspected that its distention was absolutely and literally due entirely to the stones. It was incised and the

stones removed. The wall of the gall-bladder was twice the usual thickness, but otherwise the organ was serviceable in its appearance. Some bile made its appearance at the close of the operation. The patient was discharged cured. More than a year and a half has elapsed and there has been no return of the symptoms. The volume of stones was so enormous that I detailed a responsible person to make an accurate count.

During the operation, it was estimated that at least 200 stones of small size were lost in the gauze surrounding the gall-bladder and in the act of transferring the stones to the receiver. These were not included in the count. The total number of stones removed that were counted reached the sum of 13,832, and if we include those stones that were lost we would feel safe in saying that the gall-bladder contained over 14,000 stones.

A careful search of the cystic and common duct did not reveal the presence of any stones.

The stones varied in size from that of a white mustard seed to that of a grain of corn. Roughly speaking, about 75 per cent. of the stones were the size of the mustard seed. The other 25 per cent. varied. No stones were broken and all the small ones were distinct and perfectly formed.

Desiring to collect other cases in which an unusual number of stones were found, letters of inquiry were addressed to several operators. The following answers are the result of this inquiry:

"In answer to your letter I have much pleasure in telling you the greatest number of gall-stones I have removed from one patient is 2300. They were bilirubin calculi from a female patient, age 27, and were taken from the gall-bladder, cystic, common, and hepatic ducts. The next largest number was 1058, was a man, aged 51, the next 720, the next 607, and another 568. In many cases I have removed numbers to correspond to these latter ones.

(Signed) A. W. Mayo Robson."

"I have removed in one case over 7000 stones from the gall-bladder, and over 3000 in another case from the common duct; in the latter case also there were several hundreds left uncounted. In both cases, of course, all the stones were quite small.

(Signed) B. G. A. Moynihan."

"We have had a number of cases in which there were a very large number of stones removed. The largest number we have counted was between five and six thousand.

(Signed) W. J. Mayo."

"The case in which I found the most gall-stones was that of a young man about 30 years of age who had 6780 stones from the size of half-a-grain of rice to twice the diameter of a pea.

(Signed) A. J. Ochsner."

"Answering your letter I beg to say, recently I operated upon a case of cholelithiasis, doing cholecystectomy, in which there were 2252 calculi.

(Signed) John B. Deaver."

Some cases in which a large number of stones were removed post mortem are recorded by B. G. A. Moynihan, "Gall-Stones and Their Surgical Treatment," page 34, as follows:

"Frerichs, in a woman sixty-one years of age, found 1950 stones, Dunlop (*Lancet*, 1878), in a woman of ninety-four, found 2011, Morgagni 3000, Hoffman 3646, Lagenbuch 4000, Naunyn 5000, and Otto 7802."

AUGUST SCHACHNER, M.D.,
Louisville, Ky.

ANNALS OF SURGERY

VOL. LIII

MAY, 1911

No. 5

ORIGINAL MEMOIRS.

RECENT ADVANCES IN PULMONARY SURGERY.*

WITH SPECIAL REFERENCE TO DIFFERENTIAL PRESSURE AND WOUNDS
OF THE LUNG.

BY JOHN H. JOPSON, M.D.,
OF PHILADELPHIA.

THE great advances that have been made in pulmonary surgery within a short space of time are apparent to the most casual student. We have been interested in glancing over the contributions in this field to the Transactions of this Society in the last twelve years, and it seemed to us of interest to contrast our attitude ten or twelve years ago, and that which we assume to-day.

Take, for example, the report by Dr. R. N. Downs, Jr., in December, 1898, of a case of stab wound of the chest, operated by Le Conte, whose investigations and views on this subject are so well known and so respectfully quoted (except by some German authorities), and the discussion thereon participated in by the lamented Willard, who years before had pursued careful experimental studies in lung surgery. Le Conte and Willard had firm grasp of the physiological problems encountered, but alas, the modern appliances for solving them were then, with the exception of the Fell-O'Dwyer

*The Annual Oration read before the Philadelphia Academy of Surgery, January 16, 1911.

method, as yet unheard of, while the reaction of the pleura to infection and to pneumothorax was as yet unstudied, except on clinical grounds. Direct treatment of the bleeding lung was only mentioned as a last resort, and the introduction of a drainage tube and the establishment of lung collapse was a measure greatly in advance of any then in vogue. True it is that already at least two cases of lung suture were on record before 1898,—one by Omboni¹ in 1884 for gunshot wound, and one by Delorme² in 1893 for stab wound; but both patients had died, and they were as yet without imitators.

Da Costa's bold treatment of a case of secondary hemorrhage from the lung by thoracotomy and a huge tampon was looked upon, and rightly, with the experience then at our command, as an achievement demanding great surgical courage. Consider Stewart's report in April, 1900, of a pyopneumothorax associated with fracture of the ribs, and judging from the symptoms either a laceration or rupture of the lung, and a "tension pneumothorax." Repeated aspirations failed to relieve, and opening of the chest and the introduction of a rubber drainage tube were finally practised, and successfully. How would we then have considered Garre's recommendation that thoracotomy be practised without loss of time and the wound in the lung sought for and sutured? The ingenious Hopkins³ had striven to devise valve systems of drainage for the air-containing and the infected pleura, but these were as yet Wills-of-the-wisp, or as Harte sarcastically remarked, "mechanical toys," and perhaps are little more to-day.

With the passing of time, however, we have learned some things and unlearned others; and at least two cases of suture of the wounded lung are now on record by Fellows of this Academy; although both, we remark with regret, are ignored by the patriotic German authorities (Jopson,⁴ Kelly⁵).

But in this field, we would again emphasize, the advances have been so rapid that authorities are soon outworn, and the articles on chest surgery in our best and most recently published systems miss many of the most vital points of the subject.

It has seemed to us that in considering these revolutionary changes, they embrace from an operative stand-point those measures aimed at overcoming the symptoms, at times appalling and always to be borne in mind, which may attend pneumothorax and lung collapse; and secondly, those pertaining to operative technic, as modified by the nature and resistance to infection of the pleura and the thoracic contents.

We have undertaken a study of some recent literature on these general subjects, as well as on the special subject of the operative treatment of wounds of the chest.

A brief review of the physiological conditions found in the lungs and pleura in relationship to intrathoracic pressure as distinguished from intrapulmonic pressure may be useful and is necessary to a clear understanding of the problems involved in a study of methods of differential pressure. By intrathoracic pressure is meant the pressure in the thoracic cavity outside the lungs, and which is present in the unopened pleura and mediastinum. Intrapulmonic pressure is the pressure found in the air-passages and the alveoli. At the end of both inspiration and expiration the intrapulmonic pressure is equal to atmospheric pressure, as these passages are at this time in communication with the external air. During inspiration this pressure falls and becomes negative. The degree varies with the degree of constriction in the parts above, especially including, under normal conditions, the glottis. During expiration the pressure rises. Under normal conditions of quiet respiration these variations are not great—from 7 to 10 mm. of water as measured by the manometer. If the glottis be closed, the variations in pressure are greatly increased, and these variations have a marked effect upon the heart and circulation (Howell⁶).

Intrathoracic pressure, or that present in the pleura and mediastinum, is always negative under normal conditions; that is to say, it is always less than the atmosphere. The reason for this is, to quote Howell, that the lungs are smaller than the cavity which they occupy. "The lungs are distended to fill the thoracic cavity, and consequently the organs, like

the heart, which lie in this cavity outside the lungs are exposed to a pressure of one atmosphere, minus the force of elastic recoil of the lungs." Howell defines intrathoracic pressure, therefore, "as intrapulmonic pressure, minus the elastic pull of the lungs, and since under usual conditions the intrapulmonic pressure is equal to that of the atmosphere, the intrathoracic pressure is less than an atmosphere by an amount equal to the recoil of the lungs." This negative pressure is greater during inspiration than during expiration, being, according to Heynsius, equal to -7.5 mm. of mercury at the end of inspiration, and to -4.5 mm. of mercury at the end of expiration. If by opening the chest wall and parietal pleura this negative pressure is abolished, the entrance of air into that side of the chest is attended by collapse of the lung, and pneumothorax results on that side.

Space forbids any extensive inquiry into the causes of dyspnoea and collapse which may attend pneumothorax. That these symptoms are not always or even usually present in the human subject when only one side of the chest is opened is well known and long since emphasized by Matas, Trendelenburg, and many others; and many successful operations confirm the view that they may be absent or of but moderate gravity. A dog is killed by wide opening of one pleural cavity unless some form of differential pressure is employed. The thin and easily ruptured mediastinum is the animal's undoing. The rabbit can safely undergo the same operation without fear of collapse (Robinson and Leland⁷); and it has been well said by them that some human subjects have a dog's lungs, and some a rabbit's.

The margin of safety is not large enough to disregard the methods now at hand to guard against an alarming or fatal collapse; and to-day, in Germany at least, every large clinic has a positive pressure apparatus or a Sauerbruch chamber at its disposal (Wolf⁸); no less than 35 clinics being so equipped at the beginning of the year 1910 (Robinson⁹). In this country, Meyer, Green and Janeway, Robinson, Elsberg, Lilienthal, and others are equipped, and are doing

active clinical work. In plain words, haphazard surgery would seem to have reached its limit, and except in cases of emergency, the time is at hand when the surgeon doing thoracic work must equip himself accordingly.

A brief enumeration of the theories advanced in explanation of the dangerous symptoms of lung collapse is furnished by Wolfe;⁸ Murphy and Garré seek the cause in an insufficient fixation of the mediastinal pleura, which flutters to and fro in respiration, hindering both inspiration and expiration, dyspnoea being more common than collapse in unilateral pneumothorax. Rehn attributes them to a displacement of the mediastinum to the opposite side, causing a kinking of the larger bronchi; while Friedrich sees the cause of collapse in circulatory disturbances due to kinking of the great vessels. If we add to these the view of Tiegel,¹⁰ who believes that a deficiency of lung ventilation and of oxygen is the chief danger in pneumothorax, which deficiency might be explained by either of the first mentioned theories, it furnishes us with an explanation of the successful action of the several methods which have been adopted to prevent a collapse of the lung and to maintain respiration, and thus meet the complications of accidental and operative pneumothorax.

Under the head of differential pressure, we include the several methods of prevention of pneumothorax and collapse of the lung.

Differential pressure has been tersely defined by Willy Meyer as a higher pressure within the lungs than outside of them. As is well known, this is produced in one of two ways: either by increasing the intrapulmonic pressure—the positive pressure method; or by decreasing the atmospheric pressure on the surface of the lung—the negative pressure method.

Green and Janeway¹¹ divide the forms of apparatus for artificial respiration into four classes, and this classification will suit our purpose. They are, first, those providing either negative or positive pressure, as the operator desires, the cabinets of Sauerbruch and Meyer; second, the positive pressure cabinets of Brauer, Murphy, Janeway and Green; third, the

positive pressure masks of Robinson and Tiegel; and lastly, the devices for direct insufflation through the larynx or trachea, of Fell, O'Dwyer, Doyen, Matas, Green, Volhard, and Meltzer.

That there is not any essential difference between the results obtained by the positive and negative pressure is acknowledged by many of the experimenters in one or the other field. It would seem to be a case where indeed "The ways they are many. The end it is one."

While to Sauerbruch is due the credit for the tremendous impetus which his introduction of the negative pressure cabinet bearing his name gave to the study of the subject, and while it must not be forgotten that it was he also who pointed out that by a reversal of the position of the patient in his cabinet positive pressure could be produced, it would seem that the early pioneers in the field are to-day scarcely receiving the credit that is their due; and that we in this country at least should not forget that Fell, O'Dwyer, and Matas did yeoman's service in the introduction and development of what is as truly a positive pressure method as any of the forms of apparatus of which we hear so much to-day. A parent is naturally partial to his own child, and we find Fell¹² in a recent article again calling attention to the merits which his apparatus in its latest form possesses. In the earlier forms of negative and positive pressure cabinets the intrapulmonic pressure was static, and the respiratory movements were dependent upon the patient himself. While collapse of the lung was prevented, cessation of respiratory movements would quickly end fatally, and might easily result from paralysis of the respiratory centre, whether produced by poison or shock.

The ease with which Fell overcomes this danger by his method of forced respiration, varying at will the number of respirations from 5 to 50 per minute, following when desirable the autorespirations, and controlling the degree of collapse or inflation of the lung to suit the operator, makes him doubt the flexibility of the mechanism of the cabinets, or what Carrel calls the "classical" types of apparatus. But with the

improvements which have been already obtained in some of these wonderfully ingenious and (although it must be said cautiously to avoid Meyer's sharp criticism) complicated pieces of apparatus, rhythmic changes of pressure sufficient to aid the patient's flagging respiration and to effect exchange of the air in the lung by its alternate collapse and distention can be readily obtained.

To pass on from this reference to Fell's apparatus, which he has modified to meet the demands of both positive and negative pressure, to the consideration of the classical types of apparatus, the cabinets of Sauerbruch, Brauer and Peterson, and their followers, and the masks of Robinson and Tiegel, we find that the mechanical perfection of these forms of apparatus has made great progress since Sauerbruch's cabinet was presented in 1904. Meyer¹³ and his brother have constructed a differential pressure cabinet which permits of the use of either positive or negative pressure, or a combination of the two, and which in the working out of details is the most perfect form of apparatus from a mechanical stand-point yet offered. Of course, the time required for knocking down and transporting such a piece of mechanism practically renders it available in only one institution. So, too, the positive pressure cabinet constructed under the supervision of Robinson⁹ for the Massachusetts General Hospital, while less elaborate, and much less costly, is also open to this objection. But smaller and easily transportable devices are provided in the positive pressure cabinet of Green and Janeway, and the positive pressure masks of Robinson and Tiegel. The cabinet of Green and Janeway permits of a rhythmic rise and fall in the pressure of the inspired air and ether vapor, a true artificial respiration being carried on without any effort on the part of the patient, and it can be used for respiratory failure due to any cause. The inspired air is warmed, thus overcoming an objection which has been urged against positive pressure, and the ether vapor is diluted. The patient's head is under perfect control, and the positive pressure around the patient's head in the cabinet induces a degree of cerebral anæmia, which renders less ether necessary.

A more extensive description of these cabinets is superfluous, but the large cabinet of Robinson, where the etherizer sits in the cabinet, connected by megaphone with the outside world, administering the ether in the ordinary manner except for the fact that the pressure in the cabinet is elevated to 10, 15, or 20 mm. of mercury at will, the patient's air passages free and under perfect control and inspection, and the whole interior fed with air by noiseless motor and ventilating pumps, certainly appeals to the imagination at least, as a wholly practicable device.

The positive pressure masks are exemplified in Robinson's smaller apparatus and Tiegel's mask. The description of Tiegel's¹⁴ apparatus and a citation of the results obtained by Tiegel in Henle's clinic¹⁰ lead one to believe that the method he employs may yet be found the most practicable. The apparatus is comparatively simple. The mask is similar to that used in giving nitrous oxide, and can be quickly applied or removed. Tiegel finds that the use of oxygen instead of atmospheric air has certain advantages. It is not necessary to use the same amount of pressure as with air, 1 to 2 cm. of water being sufficient in most cases of unilateral pneumothorax, higher pressure being reserved for cases of tracheal stenosis, double pneumothorax, threatened aspiration of blood, and for fully distending the lung at the conclusion of the operation. The fact that the exposed lung is not fully distended under low pressure renders manipulation easier than in the Sauerbruch method, for example, where the lung is kept in contact with the chest wall. At the same time, while using oxygen, the breathing continues regular, and there is neither dyspnoea nor cyanosis. Distention of the stomach, which has occurred under the use of other forms of positive pressure, is avoided (he cites a fatal case of Küttner's). The pressure supplied from an ordinary oxygen cylinder takes the place of the pump with its complicated parts and liability to internal disorders. The fact that his apparatus has been freely tested, not only on animals but in pressure stenosis of the air-passages, and in stab wounds, rupture of the lung, and resection

of the chest wall, has proved its practical value. Experimental work on healthy dogs is, as Meyer says, different from operations on sick people, and he quotes Tiegel himself as reminding us that "dogs do not drink, smoke, or stay out late at night."

This brings us to the last of the four methods of obtaining differential pressure, viz., that of direct insufflation through the larynx and trachea. We have already alluded to the pioneer work of Fell, O'Dwyer, and Matas in this field. Kuhn of Cassel, with his peroral intubation method; Dorrance, with his intratracheal pressure bulb tube, used in combination with the Matas clinical respiratory apparatus; Volhard and Robinson, have all contributed something to this method, and in a measure paved the way for the reception of the method of Meltzer and Auer,¹⁵ which comes to us with the stamp of approval of Carrel, and has been tested on the human subject by Elsberg and Lilienthal. It is based on the following facts: The exchange of gases in the lung is maintained by a system of ventilation. Internal respiration is the name applied to the exchange of oxygen and carbon dioxide in the tissues and the blood stream, and is dependent upon the flow of blood through the capillaries. In external respiration the movement of the air is accomplished by inspiration and expiration. Meltzer and Auer maintain an artificial respiration by imitating internal respiration, and supplying a constantly flowing stream of air under moderate pressure (15 to 20 mm. mercury) in one direction, which carries the air to a certain distance, the remainder of the distance being covered by diffusion aided by the currents excited. A tube two-thirds the diameter of the trachea is passed through the mouth, larynx, and trachea, down to the bifurcation, and then withdrawn a short distance. The pressure is supplied in the original apparatus by a foot-bellows; the air is passed through an ether bottle, and the pressure measured, of course, by a manometer. Like the masks, it is at once an artificial respiration and etherizing apparatus. There is a backward flowing stream of air which keeps the larynx and pharynx free, and anæsthesia is rapid and com-

plete; and strange to relate, overdosing with ether seems impossible. The lungs are distended, breathing is deep and regular, and interruptions of the current or reductions in pressure once or twice a minute permit temporary collapse of the lung, and aid in the diffusion of the gases.

With the aid of this simple apparatus Carrel^{16 17} has done some of his most wonderful work on the lungs, the heart, and great vessels, and the œsophagus, and finds it perfectly satisfactory; while Elsberg^{18 19} has modified and refined it by substituting an electric motor, blower, warming, and filtering apparatus, etc., to meet the exigencies of operations upon man, preserving, however, its principle. Both he^{19 20} and Lilienthal²¹ bear evidence to its satisfactory action in varied types of cases. It is perhaps but natural that this comparatively simple mechanism should excite the fine scorn of Meyer,²² who, in the discussion following its presentation, contemptuously termed it the "blow-pipe method" and opposed its utility in anything but experimental work, viewing it as a backward step of fifteen years. Some of his objections seem valid, while others have been met by the modifications already mentioned, which, as Meyer prophesied, rob it of some of its simplicity. It is a true positive pressure method after all, as Janeway pointed out in discussion, due to obstruction to the backward flow of air. It is not easy to pass a rubber tube unaided into the larynx of an adult, even for one who has had considerable experience in intubation, as we can vouch, and Elsberg uses a Jackson speculum. The interference with the toilet of the mouth and with instrumentation on the œsophagus may also militate against it; as may also a deleterious action of the air and ether vapor on the bronchi, if such be proven (Janeway).

In closing the review of this part of the subject, it will be seen that, as said before, it is generally acknowledged that there is no great advantage of one form of differential pressure over the other, as far as our present knowledge goes. Expansion of the lung can be maintained, and natural or artificial respiration preserved or practised by both methods.

Mention might be made here of the practical application to many lesions of the thoracic viscera, including the œsophagus, of both forms of pressure. To which modification we will finally come, or whether one form will be found superior under certain conditions and another under other conditions, is still more or less an unsettled question; but that differential pressure has come to stay is certain. With Meyer's universal cabinet he claims that exploratory thoracotomy is as safe to-day as is exploratory laparotomy, thus gratifying Friedrich's wish, which statement, with certain limitations, now to be taken up, may be considered true.

TECHNIC IN THORACIC SURGERY.

The importance of a most rigid technic in all operations upon the pleura, and the direct influence of infection upon the operative results are now well recognized. In both experimental and clinical work infection shares in importance with and outclasses pneumothorax as a most dangerous complication. This has been strongly brought out in an analysis of the deaths after operation in cases of wounds of the heart, 45.4 per cent. of which, according to Guibal (Matas²³), are directly due to septic infection of the pleura or pericardium or of both; in Stuckey's² series of cases of lung suture, infection was the most frequent cause of death. The well-known experiments of Notzel show greater susceptibility of the pleura to infection than is the case with the peritoneum, although less than that possessed by the synovia of the joints. The pleura possesses considerably more resistance when closed than in the presence of pneumothorax. The cessation of lung activity associated with pneumothorax means disturbance of the circulation in both the blood and lymph channels, and the resistance of the pleura at once collapses.

Carrel,¹⁷ in a recent article on the experimental surgery of the thoracic aorta and the heart, reminds us again of the fact that we are in danger of forgetting, viz., that the bulk of so-called aseptic wounds are almost always slightly infected. What would be a negligible infection elsewhere, in the pleura

becomes an important and threatening condition. Among the measures which favor such infection, Carrell includes handling with forceps and retractors, sponging, walling off with gauze, and the exposure of large surfaces to the air. Hence the innovation he practises. These are: the covering of the lung with silk compresses impregnated with vaseline, to prevent evaporation and drying of the tissues, and these covered in turn with thick flannel to prevent cooling; the exclusion of blood from the pleural cavity, and the avoidance of handling and sponging. Moreover, the operating room is kept at a high temperature, and using these precautions, he operates successfully on the œsophagus, the lungs, and the pericardium, discarding many of the suggestions, appliances, and methods of technic found necessary by other experimenters in the same field.

The relationship of pneumothorax to infection, the loss of pleural resistance associated with its presence, and the added resistance afforded by complete closure and air exclusion, will be seen to be of prime importance in considering the whole question of operations on the lung, and more acutely, the question of drainage. From our own slender experience it has always seemed that while the pleura was easily infected, and while drainage was usually followed by infection, it was rather quickly thrown off if the drainage was adequate. But such a position is no longer tenable, if taken as an excuse for the use of drainage as a routine measure or even in cases of doubt. Nearly all the statistics quoted by Matas, in his masterly article on heart wounds in Keen's "Surgery," support the view that a patient's chances are better without pleural drainage; and a study of the more or less exhaustive papers on wounds of the lung, published within the last two years, from the clinics of Körte, Trendelenburg, and Brunner, confirm this opinion. Only by the restoration of the normal physiological conditions, in whole or in part, can infection be satisfactorily controlled.

The practical applications of these considerations in regard to technic leads us to the question of wounds of the pleura

and lung, and of these the latter are by far the most important.

WOUNDS OF THE PLEURA AND LUNG.—In another part of this paper we alluded to the views which were commonly accepted and those which were new some ten or twelve years ago. The conservative treatment of such wounds is familiar to every medical student. Rest, with sealing, suture, or tamponing of the external wound, strapping of the chest, cold externally, and morphia are routine, and for the attending surgeon, easily applied and satisfactory measures. What are the untoward consequences to the patient of a too universal application of such treatment? He may continue to bleed into his pleura, and a huge hæmothorax result. If a large bronchus be wounded, with each inspiration air will be pumped into that sac, and failing means of escape externally, compress first the wounded lung, and then by pushing over the mediastinum to the opposite side, displace the heart, press upon the sound lung, and cause kinking of the great vessels and the large bronchi, and result in suffocation from "pressure pneumothorax;" or emphysema may appear, in the presence of a wound in the chest wall, or extend through the mediastinum into the root of the neck and such escape give only temporary relief from pressure. If the patient survives or escapes these immediate dangers, infection frequently develops later, introduced from without through the chest wall or from within through an open bronchus, and empyema results; or secondary hemorrhage, the result of a wound from a small calibre jacketed bullet, may finally carry him to his grave, a complication especially noted during the Boer War. Even if he escapes these accidents, experience has shown that a patient who does well in the early period may be invalidated by the development of respiratory and circulatory crippling, the result of hæmothorax, as noted in the Russian-Japanese War (Küttner). Besides the conservative and expectant treatment, it behooves us to consider the other measures which have been recommended. Aspiration for the removal of blood and air from the pleura is the most frequent minor measure. The permanent insertion of a tube between the

ribs, either to favor collapse of the lung and thereby encourage hæmostasis (Le Conte), or to allow the escape of air under pressure, in the latter case providing it with some valve mechanism to prevent admission of air from without (Hopkins, Tiegel), have both been advocated. Thoracotomy, followed by evacuation of the blood from the pleura and direct control of hemorrhage, is the most recent and apparently the ideal method.

To Garré²⁴ of Königsberg is due much of the credit for pointing out the urgent necessity in a certain number of cases for the institution of active surgical measures for direct control of hemorrhage from a wounded lung. In this epoch-making article, read before the Thirty-fourth Congress of the Deutsches Gesellschaft für Chirurgie in 1905, he presented the results of a statistical study of 700 wounds in the lung treated conservatively, dwelt upon the high mortality under such methods of treatment, and exposed some of the fallacies which had long influenced the treatment of these lesions. He pointed out that the general mortality was over 40 per cent.; in ruptures of the lung, uncomplicated by other injury it exceeded 50 per cent.; while stab wounds and gunshot wounds in the antiseptic era exhibited a death-rate of 38 per cent. and 30 per cent. respectively. He also clearly demonstrated that antiseptics as ordinarily applied could not favorably influence the internal wound which opened the lung itself; that the small calibre jacketed bullet was as dangerous as the old-fashioned projectile; and also asserted that the often repeated view that bleeding spontaneously ceased in the collapsed lung had neither clinical nor experimental confirmation. The prime indications for operation, according to Garré, were hemorrhage, abundant, persisting, or recurring, and pressure pneumothorax not yielding to aspiration. While they were only present in 5 or 6 per cent. of cases of lung injury, they demanded prompt interference. He collected nine cases of suture of the lung, including one case of ruptured lung (his own) with six recoveries. The principles of treatment, as he laid them down, are not very different from those found useful by his followers; nor has

his technic been greatly modified, except as influenced by the facilities afforded by the development of differential pressure and a better understanding of the influences of pneumothorax and its relationship to drainage.

Since the appearance of Garré's article, a number of other important contributions have appeared, including those of Küttner, Sauerbruch, Hotz, Stuckey, V. Möller, Wolf, and Grassmann. The last three, coming from the clinics of Körte,²⁵ Trendelenburg,²⁶ and Brunner,⁸ have appeared within a year or two, and set forth what may be accepted as the authoritative teaching at this time as contrasted with the extremely radical views advanced by Stuckey² of St. Petersburg, which have received wide publicity.

In determining the indications for operation in lung wounds, it would seem desirable to restore as completely as possible the normal physiological conditions of the pleura, to check hemorrhage, remove infection or the conditions favoring its development, and prevent absolutely all danger from those accidents which we have enumerated as possible sequels of such wounds. This would seem to be the ideal treatment, and it may be that in a short time we will resort to operation as promptly as we do in gunshot wounds of the abdomen. This is practically the ground taken by Stuckey, who reports from one hospital no less than 25 wounds of the lung subjected to operation and suture—an enormous number when contrasted with the sum total of those gathered from the literature by a number of investigators. Stuckey advises thoracotomy and suture in every stab wound of the chest seen within twelve hours of the time of its infliction. His cases showed a mortality of 36 per cent., and combining his cases with 7 cases of suture for stab wound from the literature, the series shows a mortality of 31.27 per cent., which he contrasts with the mortality of 38 per cent. in conservatively treated cases cited by Garré.

This paper led Körte to suggest a study of the cases in his clinic from 1891 to 1909, and V. Möller²⁵ reports them *in extenso*. This paper represents the more conservative attitude which would restrict operation to cases exhibiting

certain well-defined symptoms. In 48 gunshot wounds there was a mortality of only 14.6 per cent., while of 19 stab wounds the mortality was nil. Of 23 cases of subcutaneous rupture of the lung, 9 died, a mortality of 39 per cent. The operations included aspiration, the most frequent operative procedure; thoracotomy only twice; one suture of the lung; one tamponing of the pleura; and one or two laparotomies. V. Möller argues that in only two of the fatal cases of penetrating wounds could death have been prevented by prompt operative treatment, using our modern technic; nor was empyema more frequent than in Stuckey's series; and the lack of mortality and the much shorter period of healing in his stab wounds, is in striking contrast to Stuckey's results.

Grassmann²⁶ takes a view very similar to that of V. Möller, in restricting thoracotomy to certain rather sharply defined conditions.

The favorable outcome of some of the most desperate cases, without operation, is the stumbling block in determining when to interfere. Wolf⁸ reports four cases recovering after suture of the lung—one of rupture, a very rare case, two cases of gunshot wounds, and one of stab wound, operated by Trendelenburg himself. Positive pressure was used in the first case throughout the operation, and in the last case to remove the air from the pleura and to distend the lung before closure of the chest wall. Drainage was dispensed with in all.

The binding indications for operation in penetrating wounds of the chest would seem to be as follows:

1. A wound which from its situation and direction would render likely a penetration of the heart, pericardium, or diaphragm.
2. Severe primary or recurring hemorrhage, as shown by the physical signs of hæmothorax or external bleeding, or by severe hæmoptysis with threatened aspiration of blood into the other lung.
3. Secondary hemorrhage, especially to be looked for in gunshot wounds.

4. Severe pneumothorax, especially when accompanied by symptoms of mediastinal and cardiac displacement, dyspnoea, cyanosis, and threatened suffocation, and which is not relieved by aspiration; also when extensive and increasing external emphysema is present.

5. Secondary pneumothorax, which is always due, according to V. Möller, to suppuration or sloughing of lung tissue.

6. Empyema.

It seems certain that with the improvements in our technic, which include greater familiarity with methods of differential pressure, that these indications will increase in number rather than diminish, and that the ideal treatment, already mentioned, will in time become the accepted one; but a checking up of the results from time to time by our mortality and morbidity statistics should accompany the gradual adoption of more sweeping indications.

In a very limited series of chest wounds under our own observation, the following cases were operated:

1. A stab wound of the chest in the fifth interspace, anterior axillary line, left side, with free external and internal hemorrhage. Treated by prompt rib resection, suture of the wound in the lung, drainage of the thoracotomy wound, and posterior drainage, according to the method of Delageniere. Recovery.

2. A stab wound of the chest in the eighth interspace, anterior axillary line, left side, with moderate external bleeding and traumatopnoea. Treated within a few hours by enlargement of the wound, exploration of the pleura, lung, and diaphragm, cleansing of the pleura, and closure of the wound, with superficial drainage only. Recovery.

3. A stab wound of the chest in the second right interspace, two and a half inches from the sternum, which entered obliquely and divided the internal mammary artery. Operated for recurrent hemorrhage the same day. Ligation of the artery. Partial closure, with drainage. Death from hemorrhage.

4. A case of stab wound in the second interspace, left side. Admitted during Dr. Wharton's service, and treated at first by conservative measures, and later by aspiration on two occasions. Empyema developed, and we resected a rib five weeks after his admission. Recovery.

5. A stab wound of the chest penetrating the pleura between the scapula and the spinal column, and associated with multiple non-penetrating wounds of the back. Operated within a few hours for persisting hemorrhage and hæmothorax. Owing to the position of the wound exploration was unsatisfactory, and tamponing was resorted to. Infection of the pleura followed, and rib resection and drainage were finally necessary. Recovery.

6. A gunshot wound of the chest, self-inflicted, in the third interspace, left side, one and a quarter inches from the sternum. Operated the same day for suspected wound of the heart. Thoracotomy and formation of a quadrilateral chondroplastic flap. Pericardium uninjured. Temporary control of hemorrhage by insertion of large gauze laparotomy pads. Spontaneous cessation of hemorrhage, and closure of the wound with superficial drainage only. Death in four days from delirium tremens.

7. A gunshot wound of the chest below the precordial region on the left side, with penetration of the diaphragm, gastro-hepatic omentum, and kidney. Laparotomy performed the same day, stomach and intestines examined and found uninjured. Temporary improvement, interrupted by streptococcic throat infection, otitis media, and symptoms of lung infection on the right side, with sudden unexpected death several days later. No autopsy.

8. We have also operated upon one case of rupture of the lung, in which the most alarming thoracic shock was present for 36 hours, and which developed empyema later, for which rib resection was done. This patient recovered.

It seems to us that this list, small as it is, emphasizes some of the accidents, immediate and remote, which are frequently met with in chest wounds and injuries. It includes only one case of wound of the diaphragm, treatment of which by the transthoracic route has certain advantages which are now recognized. Nor does it include any well-defined case of "tension" or "pressure" pneumothorax so called (*Spannungspneumothorax*), which is one of the most urgent indications for operation, or any wounds of the pericardium or heart. But our experience has been sufficient to convince us that the too optimistic views often voiced in regard to chest wounds, and an over-conservative attitude in their treatment, will sooner or

later lead us all into trouble, and that the attitude which we are now forced to assume is one which is based not alone on physiological and experimental but on truly clinical grounds.

Operative Technic.—Where differential pressure is available, it will usually be employed; or if not used throughout the entire operation, it is useful at its termination before closure of the opening in the thorax, to distend the lung and abolish pneumothorax. It has been used in a number of cases of wound of the lung with the greatest satisfaction, five cases being collected by V. Möller.

Elsberg^{27 28} emphasizes the fact that both in experimental and clinical work the patient breathes better if lying in the prone position when the chest is opened, and he has recommended this position in operations on the lungs and pleura. The weak anterior mediastinum receives more support in this position, and coughing and respiratory disturbances were absent in empyema cases so operated, while the exposure was excellent. We have tried it in several cases with good results.

The remarks on the aseptic technic, already quoted, are to be borne steadfastly in mind. They need no repetition.

In the presence of a wound, the opening in the chest wall should usually be planned to include it, unless in operating late for infection alone, when the site for drainage is chosen according to the indications common to empyema cases of other origin. Resection of one or more ribs or the formation of an osteoplastic flap is advisable. Intercostal incision, with the use of a powerful rib spreader, is feasible. The lung is at once seized and pulled outward into the wound, using the hand and holding the lung with moist compresses, as Rehn recommends, or adopting the suggestion of covering the rubber glove with a cotton glove to obtain a firmer grasp. Instruments are prone to lacerate the lung tissue. Traction on the lung, drawing it into the wound, as recommended by Rehn, is especially useful when differential pressure is not used, as entrance of air into the pleura is in a measure prevented, while the traction on the mediastinum steadies it and helps to overcome the respiratory and circulatory dis-

turbances incident to pneumothorax. An examination of the surface is then made for wounds and lacerations. Wounds are sutured whether bleeding is present or if it has ceased, unless situated at the hilus and not accessible for suture, when tamponing may be necessary. In such cases Bramann recommends suturing the wound in the parietes around a large tube provided with a rubber tissue valve. In gunshot wounds the wound of exit from the lung must not be forgotten; failure to suture it may result fatally, as recorded in one case (Delbet).

Lacerated and badly soiled areas may call for excision, preferably wedge-shaped, while clots and foreign bodies are to be removed. The sutures, either of silk (as Talke prefers) or catgut, passed with a round pointed needle, are inserted near the edge of the wound, and penetrate the entire depth, being tied firmly enough to secure hæmostasis and occlusion, but not so tightly or so closely as to cause atelectasis. The visceral pleura may then be sutured over the wound to secure early occlusion. The lung tissue itself heals readily when the wound edges are neatly approximated. Broad lacerated surfaces may be sutured into the wound, shutting off the general pleural cavity (Jonnesku); especially if suturing fails to control hemorrhage (Brunswick). The pleura is cleansed of blood and clots, and preparations made for closure of the wound. Where differential pressure is not used to secure expansion of the lung, it is recommended by Bayer to suture it to the wound in the parietes before closure, as this favors expansion; otherwise it is released and the wound closed by layer suture with superficial drainage. Drainage of the pleura in primary cases is usually contraindicated for the reasons already given. Wolf's report of four successful cases, including one stab wound, two gunshot wounds, and one of rupture of the lung, all treated without drainage, is very convincing.

When packing is necessary in an inaccessible wound, or when gross infection is present, as shown by pleural exudate, and exceptionally under other circumstances, as when a large bronchus is wounded and cannot be sutured, drainage will be

necessary, and under such circumstances drainage posteriorly is preferable (Delagenieres' method).

Of 26 cases of gunshot wound collected by V. Möller, operated according to the usual indications of hemorrhage, pneumothorax, emphysema, or suspicion of heart injury, 11 died (42 per cent.); 20 were sutured with 7 deaths; 2 were sutured to the opening in the pleura, with 1 death; 2 in which the lung was resected died; and 1 in which the pleura was packed, recovered.

Of stab wounds he collected 10; 7 were sutured, with 1 death; and 3 were treated by tamponing the pleura, with no deaths. There were also 19 unclassified injuries to the lung, of which 18 were sutured, with 7 deaths; and 1 case treated by tampon, which recovered.

Stuckey's cases, operated without regard to the usual indications, are not included in these statistics, which are the most elaborate and most recent, although not complete as regards the American literature.

In *rupture* of the lung the question of operation is also to be carefully considered before interference is practised or discarded. The mortality is higher than in the case of penetrating wounds, being 50 per cent. after deducting all deaths due to accompanying injury to other organs (Richter-Wolf). If operation is to be of value, it must usually be practised early, as the lacerated lung, lying in a pleura filled with blood, soon becomes infiltrated and hepatized, as shown by Garré. The pneumothorax which is due to a limited laceration of the parenchyma, like that associated with small penetrating wounds, may be of trifling significance; but if a large bronchus be torn, air may be pumped into the pleura with each inspiration, and its exit hindered by a valve-like closure of the bronchus. Dangerous or fatal pressure on the heart and the opposite lung quickly results under these conditions. Profound shock is a familiar picture in these cases, and after it passes away, hæmothorax, pneumothorax, and wide-spread emphysema often develop. The cases associated with fracture of the ribs give the highest mortality. Wolf says that if, after

the period of initial shock has passed the patient's facies show an increasing paleness and cyanosis, or if signs of hæmothorax, with difficult breathing, small frequent pulse, and anxious expression are present, operation is indicated. Garré operated for rupture of the lung on the fourth day after the injury, too late to save his patient, but Wolf was more fortunate in his case. He operated under positive pressure, sutured a tear in the lower lobe 5 cm. in length (the site of active hemorrhage), cleansed the pleura, elevated a depressed and fractured rib, sutured it in place, and closed the pleura without drainage. The patient recovered, a triumph of surgery.

REFERENCES.

- ¹ Küttner: Deutsche Zeitschrift f. Chirurgie, 1908, xciv, 1.
- ² Stuckey, L.: Archiv. f. klin. Chirurgie, 1909, lxxxviii, 767.
- ³ Hopkins, B. H.: Trans. Phila. Acad. of Surgery, April, 1900.
- ⁴ Jopson, J. H.: Trans. Phila. Acad. of Surgery, Oct., 1905, ANNALS OF SURGERY, 1906, xliii, p. 150.
- ⁵ Kelly, Jas. A.: Trans. Phila. Acad. of Surgery, Nov., 1909, ANNALS OF SURGERY, 1910, li, p. 275.
- ⁶ Howell, W. H.: Text Book of Physiology, 3d Ed.
- ⁷ Robinson and Leland: Surgery, Gynæcology and Obstetrics, 1909, viii, 255.
- ⁸ Wolf, W.: Brun's Beiträge z. klin. Chirurgie, 1910, lxvi, 51.
- ⁹ Robinson, S.: Surgery, Gynæcology, and Obstetrics, 1910, ix.
- ¹⁰ Tiegel, M.: Brun's Beiträge z. klin. Chirurgie, 1910, lxviii, 584.
- ¹¹ Green, N. W., and Janeway, H. H.: ANNALS OF SURGERY, 1910, lii, 88.
- ¹² Fell, J. E.: Surgery, Gynæcology, and Obstetrics, 1910, x, 572.
- ¹³ Meyer, W.: Jour. Amer. Med. Assoc., 1909, liii, 1978.
- ¹⁴ Tiegel, M.: Brun's Beiträge z. klin. Chirurgie, 1909, lxiv, 356.
- ¹⁵ Meltzer, S. J.: Med. Record, 1910, lxxvii, 477.
- ¹⁶ Carrel, A.: Med. Record, 1910, lxxvii, 491.
- ¹⁷ Carrel, A.: ANNALS OF SURGERY, 1910, lii, 83.
- ¹⁸ Elsberg, C. A.: Med. Record, 1910, lxxvii, 493.
- ¹⁹ Elsberg, C. A.: ANNALS OF SURGERY, 1911, liii, 161.
- ²⁰ Elsberg, C. A.: ANNALS OF SURGERY, 1910, lii, 23.
- ²¹ Lilienthal, H.: ANNALS OF SURGERY, 1910, lii, 30.
- ²² Meyer, W.: Medical Record, 1910, lxxvii, 483.
- ²³ Matas, R.: Keen and Da Costa's System of Surgery, vol. v.
- ²⁴ Garré, C.: Archiv. f. klin. Chirurgie, 1905, lxxvii, 209.
- ²⁵ V. Möller: Archiv. f. klin. Chirurgie, 1909-10, xci, 295.
- ²⁶ Grassmann, M.: Münchener med. Woch., 1909, lvi, 2089.
- ²⁷ Elsberg, C. A.: Jour. Experimental Medicine, 1909, ii, 444.
- ²⁸ Elsberg, C. A.: Med. Record, 1908, lxxiii, 846.

INJURY AS A CAUSATIVE FACTOR IN CANCER.*

(Continued from page 488 of last issue)

BY WILLIAM B. COLEY, M.D.,

OF NEW YORK,

Professor of Clinical Surgery, Cornell University Medical College; Attending Surgeon to the General Memorial Hospital for the Treatment of Cancer and Allied Diseases; Attending Surgeon to the Hospital for Ruptured and Crippled.

I have personally observed only very few cases of intra-abdominal cancer definitely associated with antecedent trauma. One of the most striking cases in which I found any connection between an injury and the subsequent development of a tumor was one in which I was called as medical expert some years ago. Inasmuch as in this case (Dr. H. B. Delatour's of Brooklyn) the relationship was much more definite than in the case cited by Segond, I feel warranted in giving a somewhat detailed history of the case here:

CASE VIII.—E. P. F., male, forty-four years of age. In December, 1898, in an accident of the Pennsylvania R. R., patient was thrown violently against a water tank, striking in the upper abdomen, causing marked ecchymosis, nausea, and pain, some vomiting of blood, which lasted for two to three weeks. He was confined to the house for about three weeks. He continued to get worse, and in February, 1901, he was seen in consultation by Dr. Delatour. No tumor could be felt at that time. In May, 1901, a mass could be made out in the right upper abdomen. An exploratory operation was performed, and a large number of tumors of the mesenteric glands were discovered. The patient died of shock following the operation. Autopsy showed the mesenteric glands in the upper abdomen markedly enlarged, some being the size of a hen's egg. The pancreas was likewise involved by similar growths. Microscopical examination showed the growths to be sarcoma. At the first trial in court, the jury disagreed and a settlement was effected before the second trial was called.

CASE IX.—*Intra-abdominal cancer following trauma. Carcinoma of the ovary.*

Mrs. W., age fifty-seven years. Family history good. In the early part of 1909 had such a severe fall upon the ice, that she felt as though her bladder had been ruptured. Three or four weeks later, noticed a lump in the lower abdomen. She was operated upon by Dr. Wynkoop, March 16, 1909; a large tumor was removed from the right ovary. Microscopical examination showed it to be malignant. July, three months later, a very extensive recurrence was found occupying the whole lower abdomen. This increased very rapidly in size. I saw patient in August, 1909, at which time the whole abdomen was filled with a large tumor apparently connected with the uterus. It had the appearance of carcinoma rather than sarcoma. Toxin treatment was tried for a number of weeks, but patient showed no improvement. Death occurred a few months later.

The medicolegal aspect of the question of the relationship of trauma to the development of cancer has been very carefully considered by Segond. He believes the following to be the most important points in this connection:

1. Age of a person injured.
2. Predisposition, both general, *e.g.*, hereditary, and acquired or local predisposition by way of previous inflammations or irritation. (Predisposition is not considered by the French or German courts.)

3. The condition of the locality prior to the injury.

As regards age, if younger than the ordinary age for the development of carcinoma, the responsibility of the accident would be augmented. This, however, is a special consideration, rarely applicable.

As to the state of the part before the accident, this is the most important of all considerations, and every effort should be made to determine this. In a medicolegal examination, the following points should be established:

1. The exact diagnosis of the tumor.
2. What changes may have occurred at the injured site between the time of the accident and the development of the tumor.
3. The exact interval that elapsed between the injury and the development of the tumor.

Segond gives five so-called guarantees that he regards necessary to establish the connection between the injury and the tumor :

1. The authenticity of the trauma.
2. Sufficient importance or severity of the trauma.
3. The integrity of the part prior to the injury.
4. Correspondence of the tumor to the exact site of the injury.
5. A date of appearance of the tumor, not too remote from the time of the accident to be reasonably associated with it.

The interval elapsing between the injury and the development of the tumor, Segond regards as an exceedingly delicate question. Certain authors have put into exact figures the time during which the tumor should develop to be reasonably associated with the injury. René Sand states that in sarcoma the interval should be between 3 weeks and a year; in carcinoma, from 6 weeks to a year; in glyoma, 1 month to 6 years; other tumors, 3 weeks to 2 years.

Machol states that a sarcoma of traumatic origin should develop 3 weeks or more after the accident; a carcinoma up to 2-3 years or even later. Heckinger estimates 2 years as the extreme limit within which a trauma can be reasonably regarded as playing a causative rôle.

Segond regards any absolutely definite time limit, as attempted by the preceding writers, to be of no value. According to same, he says, one might have to rule out a sarcoma which developed immediately after a traumatism. To the question, "Should one rule it out?" he replies: "by no means, nor inversely, can we rule out injury as a causative factor in epithelioma which resulted more than 3 years after the accident."

A sixth guarantee regarded of considerable importance by some writers is the continuous presence of pathological manifestations, such as pain, swelling, hæmatoma, etc., at the site of the injury up to the time of the appearance of the tumor.

Segond would add a seventh guarantee, namely, a histological verification of the cancer. This, would, of course, mean its removal by operation.

In conclusion he states that when these seven conditions just described have been fulfilled, one is able to accept the responsibility of the accident; and even when the guarantees are reduced to the first five, the same conclusion would hold before the law, and we have the right to award an indemnity, although we may still entertain scientific doubts.

My own experience with the medicolegal side of this question is confined to three cases:

CASE X.—*Sarcoma of forearm—spindle-celled.*

Mrs. B., aged thirty-eight years, had always been in perfect health; no family history of cancer. During an ocean voyage was struck over the middle of the upper part of the forearm by a falling wash-bowl in the cabin, causing a slight bruise. This disappeared. Two to three weeks later, at the exact site of the injury, there developed a small, hard tumor which rapidly increased in size and was removed when it had reached the size of an olive. Microscopical examination proved it to be spindle-celled sarcoma. It recurred locally several times, and in spite of toxin treatment and amputation at the shoulder-joint, proved fatal within two years.

Suit was brought against the S. S. Co. Two trials resulted in a disagreement of the jury; at the third trial the jury gave a verdict of a large sum in favor of the plaintiff.

CASE XI.—*Sarcoma of the retroperitoneal glands involving the pancreas* (already cited in another connection as Case VIII).

E. P. F., male, age forty-four years. December, 1898, in a railroad accident was thrown violently against a projecting water tank, striking upper abdomen. Some vomiting of blood, pain, and nausea, lasting from two to three weeks. Patient was confined to his house for three weeks. Next two years was disturbed by epigastric pain and vomiting, sometimes blood. Careful examination by Dr. Delatour, February, 1901, showed no tumor. Two months later, tumor could be felt in right upper portion of abdomen. Exploratory operation showed a large number of tumors in mesenteric glands. Patient died of shock following operation. Autopsy showed glands in upper abdomen greatly enlarged. Microscopical examination of tumors showed them all to be sarcoma.

Case tried against the Pa. R. R. resulted in a disagreement of the jury. It was finally settled out of court.

CASE XII.—*Carcinoma of the liver, primary, following severe injury.*

J. T., male, aged thirty-five years; always enjoyed good health until December, 1909, when he was injured in a train collision in which the car was nearly telescoped. His injuries consisted in severe and very extensive general contusions, principally of the head, spine, and sacrolumbar region. He was unable to walk after the accident, and remained in bed for $4\frac{1}{2}$ weeks. It was at first believed that he suffered from a fracture of the spine. He gradually became stronger, so that he was able to walk moderate distances, and on March 24, 1910, when I first examined him he could walk about a mile. He then had lost 24 pounds in weight and suffered constant pain in the back. Physical examination at this time, three months after the accident, showed the following: weight had fallen to 111 pounds (normal weight 175 pounds), the skin was soft and flabby, showing evidence of rapid loss of weight. Temperature, 99.5° ; pulse, 88; knee-jerks exaggerated; sensation normal. Examination of the abdomen showed nothing abnormal, except very marked rigidity in the muscles of the upper abdomen, particularly in the recti muscles. There was marked tenderness in the dorsolumbar region and spine. The X-ray showed an abnormality in this region of the spine, but no evidence of a fracture.

I made a second examination of the man on June 28, 1910, three months later, and found him to have gradually failed since the first examination; his weight had fallen to 106 pounds. He was markedly emaciated, somewhat cachectic in appearance; he could still walk, but was rather feeble. Patellar reflexes were still much exaggerated and sensation considerably diminished in thighs and legs. Examination of the upper abdomen showed, in addition to marked rigidity of the recti muscles, a hard swelling in the epigastric region, a little to the left of the median line, apparently intra-abdominal. My notes of the case state: "The tumor is apparently located in the stomach or the omentum overlying the stomach, and is in all probability of malignant nature." In my diagnosis, I stated: "I believe that the claimant is suffering at present chiefly from a tumor of the stomach and omentum, probably malignant in nature. He will probably not live more than six months." The patient died on Sept. 24, 1910, and autopsy showed an extensive carcinoma, involving nearly all the abdominal organs, but apparently primary in the liver.

The pathologist was unable to determine whether the tumor was carcinoma or sarcoma, but that it was a malignant tumor there was no doubt.

While it is impossible to say that the injury in this case was the cause of the development of the tumor, the probabilities in favor of a causal relationship are much stronger than in many cases in which such relationship has been accepted abroad. Here we have a man in perfect physical condition prior to the accident, direct evidence that he suffered from extensive contusions, rapid and continuous failure of health immediately after the accident, marked rigidity of the epigastric region three months after the accident, with the development of a large sized malignant tumor found six months later, in the same region.

NOTE.—This case never came to trial, for the reason that the person resided in a State in which there existed the peculiar law that, "if the next of kin be an alien or non-resident," no suit for recovery of damages is permitted

During the discussion at the French Congress of Surgeons in 1907, Professor Thiem, of Cottbus, stated that Virchow thought that irritative causes must be of very great importance in the origin of abnormal tissues, especially in the cause of cancer. Among these irritative causes are chronic inflammation, cicatrices, bacterial irritation, and, more rarely, a single trauma. Thiem admits that the cause of carcinoma is still plunged in darkness. We cannot, for this reason, fail to recognize from clinical observation that, in rare cases, cancerous tumors may develop at the site of an injury, not only after prolonged and repeated injury, but also after a single trauma. Just how they do originate, we do not know. He believes that it is impossible that a trauma determines the site of a metastatic growth, that is to say, that a bruised or contused point may furnish favorable ground for the development of a cancerous embolism. The transported cell of the carcinoma is in need of living tissues for continuing its development.

My own case (Case II) proves the direct opposite of this contention, at least for sarcoma.

In connection with the medicolegal aspect of the question of the influence of trauma upon tumor development, Thiem (Second International Conference for the Study of Cancer, Paris, Oct. 1-5, 1910) states that inasmuch as the true cause of cancer is as yet shrouded in darkness, it is all the more important to investigate the contributive causes, such as trauma (acute, repeated, or continued), heredity, contagiousness, etc. Among the various contributive causes he considers as deserving of special attention the determination of the influence of a single blunt or acute trauma upon the development of a cancer. He holds that *every wound*, whether it heal by primary union or not, or whether it result in abscess or fistula formation, may contribute to the development of a cancer by virtue of the inflammatory irritation and cicatrization, and he also believes that the same conditions obtain in cases of blunt injury in which the *skin or mucous membrane remains intact*. Here, too, he states, we have to deal with processes of inflammation or restitution which are capable, just as in an open wound, of acting as an irritant upon the tissues. However, there is a difference. The comparatively favorable course of subcutaneous injuries implies a more rapid healing process. It is not to be assumed that in such cases as healing without leaving any anatomical changes, a condition of irritation sufficient to appreciably contribute to the development of a cancer should persist. He, therefore, believes that a causative relationship between such blunt trauma and the development of a cancer at the site of the injury may be ruled out after two years from the time of the injury, provided, of course, that a true history, a *restitutio ad integrum*, has been obtained. With this statement I cannot concur.

Thiem places emphasis upon the point that the irritation caused by a trauma is but one of the auxiliary causes, though perhaps the most important, in the development of cancer. That the main cause, the as yet "unknown quantity," must be added is shown by the following case of Beigel's: In a man, seventy-four years of age, both of whose feet had been operated upon at Lisfranc's joint during childhood, a cancer devel-

oped in the cicatrix of the right side, and on the left, a cornu cutanea.

Röpke (*Habilitationsschrift*, 1905) tries to throw some light upon the question of the significance of trauma for the development of carcinoma and sarcoma. He bases his observations on a study of the material at the Surgical Clinic at Jena. His statistics show that in a series of 800 cases of carcinoma plus a larger number of cases in which the carcinoma developed as a result of chronic irritation, only 19 were caused by one single trauma. In a series of 189 cases of sarcoma, chronic irritation was the cause of the disease in 28 instances, a single trauma in 19 cases, showing trauma to be an important factor in the development of these tumors, and showing, furthermore, that in the case of sarcoma the single trauma plays a more important rôle, while in carcinoma chronic irritation seems to more often be the cause of the disease. These facts, he believes, speak strongly in favor of Virchow's irritation theory, which, contrary to Bilioth's, does not assume a predisposition or specific diathesis for the tumor formation, but rather favors the idea of a local disposition which may be either hereditary or acquired.

Röpke holds, however, that in addition, a disposition of the entire organism as well as a family disposition has to be considered, just as in the case of infectious disease.

At the close of his article, Röpke reports two cases in which the influence of a trauma in the localization of a metastatic sarcoma could be clearly proved. In both cases a tumor developed at the exact site of contusion within one week from the receipt of the injury. The originally small metastatic tumor gradually increased until it far exceeded the primary growth in size. He calls attention to the great similarity existing between these cases and the development subsequent to a trauma osteomyelitis and tuberculosis, in which so frequently most insignificant injuries furnish the exciting cause for the localization of the infection.

Ziegler (*Münchener med. Wochenschr.*, 1895, p. 621) gives an analysis of 170 cases of carcinoma, of which 37 cases, or 22 per cent., gave a history of a single antecedent trauma. He

also quotes Estlander, who reported 59 cases with 15 single antecedent traumas, or 25.4 per cent.; Snow, with 32 single traumas in 143 cases, or 22 per cent.; Henry, 196 cases with 33 single traumas, or 16.8 per cent.

Ziegler has collected 171 cases of sarcoma, *i.e.*, 81 males and 90 females, with a history of a single antecedent trauma in 35 cases, and of chronic irritation (including warts) in 32 cases.

The highest percentage of cases of antecedent trauma in sarcoma, especially of the long bones, is that brought out by Samuel Gross in his classical paper on sarcoma of the long bones. In 165 cases there was a history of previous injury in nearly 50 per cent.

The most exhaustive paper, dealing with the subject of traumatic tumor formation, is the one by Carl Löwenthal (*Arch. f. klin. Chir.*, Bd. xlix, 1894-5). The paper occupies 200 pages of text and contains a very complete bibliography comprising 360 references prior to 1895.

He states that on the basis of his material, *viz.*, 750 collected cases plus 50 observed at the Pathological Institute of Munich, the conclusion would seem justified, that external injury may undoubtedly give rise to the development of a tumor, therewith admitting the direct etiological relationship between trauma and tumor formation.

Three hundred and fifty-eight, or 44.7 per cent., of the cases were carcinoma; 316, or 39.5 per cent., sarcoma.

As regards the ages of the sarcoma cases, Löwenthal's statistics show the greatest number to have occurred between the twenty-first and thirtieth years, namely 65 per cent. of 297 cases in which the age was stated. The youngest patient was 5 months, the oldest 78 years at the time of observation by the physician.

The time intervening between trauma and tumor formation is stated in 190 of the cases, and ranges from almost immediate appearance of the sarcoma to an interval of 49 years, *i.e.*, in 135 cases it was 1 month or less; in 33 cases it was 1 month to 1 year; in 22 cases it was more than a year.

In Liebe's table, the proportion of tumors immediately

or soon following a trauma is somewhat smaller. Of 107 cases of sarcoma mentioned in his statistics, definite data regarding the time intervening between trauma and tumor were given in 75, and in these the sarcoma was noticed within one month in 34 cases; within 1 month to 1 year in 27 cases; more than a year after the trauma in 14 instances.

Löwenthal points out as of special interest one case observed at the Pathological Institute of München, in which a sarcoma of the femur developed in the callus of a shot-wound fracture with imperfect union, that had occurred 18 years before. He states he could find but two analogous cases recorded in the literature.

Of the 316 sarcoma cases, 216, or 68.4 per cent., were men; 97, or 30.7 per cent., women; 3 sex not known.

As to the kind of trauma, it is seen that in the majority of cases the sarcoma developed from a single blunt injury; 79 times it was a fall; 56 times a kick; 43 times a blow.

As regards the frequency of tumors resulting from a trauma, statistics vary greatly. Liebe, for example, found from the records of the Strassburg Surgical Clinic, May, 1872, to May, 1881, in a series of 343 cases, 37, or 10.8 per cent., that were attributed to trauma. Of these 221 were carcinoma, with 22, or 10 per cent., of traumatic origin; 42 sarcoma, with 3, or 7.1 per cent., due to a trauma.

Wolf, in reviewing the records of the Berlin Surgical University Clinic, reported 82 cases of traumatic origin in a total of 574 cases, or 14.3 per cent., of trauma; 344 of these cases were carcinoma, with 42, or 12.2 per cent., due to a trauma; 100 sarcoma with 20, or 20 per cent., ascribable to an injury.

Löwenthal states that all the larger statistics show sarcoma to be the type of tumor which most frequently develops as a result of an injury. He refers to Gross's paper on sarcoma of the long bones, with a history of trauma in nearly one-half of the cases.

G. Wild, who collected 423 cases of sarcoma, found 15 in which an acute or single trauma was given as the cause.

Kirchner, in his statistical remarks on 76 cases of sarcoma of the long bones, found a trauma to have been the cause of the disease in ten.

Löwenstein (*Beitr. z. klin. Chir.*, Bd. iii, 1906, p. 780) of Czerny's Clinic, after reviewing the divergent opinions expressed by the various writers upon the subject of trauma as an etiological factor in tumor formation, concludes that there can be no doubt that trauma plays a rôle in the development of sarcoma or other tumors. The exact nature of the part trauma plays in this connection has not yet been determined, nor have the conditions upon which a tumor should be attributed to an antecedent injury as yet been theoretically defined.

As regards the legal importance of such connection between trauma and tumor formation, Löwenstein states that no general rules can be laid down, but that each case should be separately considered and carefully judged according to the origin of the tumor, its development, and course.

In answering the question as to why so few of the many thousands of traumas that occur daily result in a sarcoma or other malignant tumor, Löwenstein offers the following hypothesis: That there must be an individual predisposition to cancer at the time of a trauma that results in a malignant tumor, and this temporary predisposition he believes due to physiological endogenous or abnormal exogenous conditions in the general health of the individual, or, lastly, to abnormal local conditions confined to one organ. This is equivalent to saying we cannot answer this question.

CASE XIII.—*Extraspinal sarcoma of the back.*

D. S., male, age five years (Feb., 1911). Always perfectly well until June, 1910, when playing with some other boys he was knocked down and run over by an express wagon, the latter passing over his body. No bones were broken, and he was apparently not seriously hurt. Nothing unusual was noted until three months later, when he began to have pain in the left lumbar region. This continued, and gradually increased in severity. January 12, 1911, he was brought to the Hospital for Ruptured and Crippled. While nothing definite could be made out by a physical examination, in view of the location of the pain

he was admitted on the diagnosis: possible perinephritic abscess.

Early in February he developed gradually increasing difficulty in walking, not so largely due to loss of power in the legs as to the severe pain caused by walking. The patellar reflex on the left side began to diminish and was almost lost February 15.

Physical examination at this time showed no changes in sensation; slight loss of power in the adductor muscles; on the left side of the spine a very slight fulness could be seen and also felt on palpation. This fulness was apparently due to some swelling beneath the muscles, probably originating in the periosteum of the spinous processes. The clinical diagnosis of extraspinal tumor, probably sarcoma, was made.

The patient was examined shortly afterward by Dr. Pearce Bailey, who confirmed the diagnosis and could find no evidence of interspinal trouble. The X-rays showed no abnormalities in the vertebræ. February 17, under ether anæsthesia, I made an incision over the middle of the swelling; cutting through and separating the muscles I found an infiltrating growth apparently starting from the spinous processes or laminæ of the lower dorsal and upper lumbar vertebræ, to the left of the median line. A portion of the tumor was removed for microscopical examination. Clinically it had the appearance of sarcoma.¹

This case is a good illustration of what I believe to be true, namely, that the number of cases of known antecedent trauma is really considerably smaller than the number of cases in which such trauma was actually present. The hospital history of this case made no mention of trauma. It was only the day before the operation, on my insisting that a more careful history be obtained from the parents, that the fact was brought out that the child had been run over by an express wagon in June, and yet no mention of it was made in the hospital records.

The following cases, the more interesting of the series, are given in more detail than in Tables I, II, and III.

CASE XIV.—*Sarcoma of the clavicle.* I. M. V., male, sixteen years of age. In October, 1909, slipped in going down-stairs

¹ The microscopical report showed only fibroma, but I believe too little of the actual tumor was removed for a diagnosis.

and, in trying to recover himself, caught hold of the banister, causing severe strain of the shoulder. Four weeks later he began to have pain and soreness in the same shoulder, which continued to increase. One week later, examination by a physician revealed a well-marked fusiform swelling in about the middle of the clavicle. X-ray examination, together with the clinical history and physical signs, made the diagnosis of sarcoma clear, and I immediately removed the entire clavicle. The growth proved to be a spindle-celled sarcoma.

CASE XV.—*Sarcoma of scapula*. J. N., male, age two months (June 20, 1910). Mother had difficult labor; shoulder strained at child-birth. A week afterward a tumor was noticed in the midscapular region on the right side; this grew rapidly, and two months later was three inches in diameter.

CASE XVI.—*Sarcoma of the lower jaw (delayed)*. N. M., female, thirty-seven years of age; family history negative. Ran against wall in the dark, striking right side of lower jaw a severe blow, causing a black and blue area over the whole face. One year later, received another blow in the same locality. Two to three months later, noticed a bony tumor over the ascending ramus of the jaw at the site of the injuries. Operation proved it to be an osteosarcoma.

CASE XVII.—*Sarcoma of the scalp*. M. C., female, thirty-six years of age (April, 1898). Three and a half years ago, while leaning out of the window, the latter fell a distance of two feet, striking the top of her head, causing no external wounds but merely a bruise. Six months later, a tumor the size of a marble was noticed at the exact site of the injury. This continued to grow, and when it was 3 in. in diameter was removed by operation. Microscopical examination proved it to be a round-celled sarcoma. Several operations, each followed by rapid recurrence; death from general metastases three years later.

CASE XVIII.—*Sarcoma of supraclavicular region*. Mrs. J. B., aged fifty-six years; family history good. While drawing water, the windlass fell back and struck her a severe blow over the right shoulder. A few months later there developed a swelling just above the clavicle, which increased rapidly in size until it involved the entire supraclavicular, pectoral, and deltoid regions, associated with great œdema of the arm; very rapid progress of disease; death within a little over a year.

CASE XIX.—*Sarcoma of the thigh—round-celled (acute)*. G. M., male, thirty-eight years of age; family history good. While getting out of a milk-wagon, struck right thigh against door of same, causing marked ecchymosis. Three to four weeks later noticed a small lump in the muscles of the thigh at the exact site of the injury. The tumor at first was very movable; grew with great rapidity, so much so, that it was regarded as an abscess; it bled so profusely on incision, that the femoral artery had to be tied later. Rapid recurrence followed several removals; death within a year from the time of injury.

CASE XX.—*Spindle-celled sarcoma of thigh*. H. M., female, thirty-nine years old; family history good. Ran against a lounge, bruising right thigh, in December, 1898. Noticed a swelling at the exact site of the injury two weeks later; this gradually increased in size; removed one year later, when it had reached the size of a fist. Rapid recurrence followed operation.

CASE XXI.—*Spindle-celled sarcoma of buttock*. Mrs. J. P., fifty-two years old; family history good. In September, 1907, fell through broken floor of veranda, receiving a severe contusion of right buttock. A swelling appeared shortly afterward, which was supposed to be a hæmatoma; this increased in size, and on removal proved to be a spindle-celled sarcoma; rapid recurrence; death within less than a year.

CASE XXII.—*Round-celled sarcoma of the supraclavicular region (acute)*. Miss A. W., forty-six years of age. In February, 1909, a heavy window fell and struck her at about the junction of the middle and inner third of clavicle, causing severe bruises. One week later she noticed a swelling at the exact site of the injury; this slowly increased in size until it infiltrated most of the supraclavicular glands. Microscopical examination showed it to be round-celled sarcoma.

CASE XXIII.—*Carcinoma of breast (delayed)*. Miss C., aged forty-eight years. Family history negative. In 1895 fell from bicycle and received a severe blow from the handle-bar upon the left breast. Four years later, noticed a small, hard lump the size of a walnut at the exact site of the old injury; operation two years later; removal of breast and axillary glands.

CASE XXIV.—*Multiple sarcoma—acute traumatic malignancy*. (Case of Dr. Teter's, of Newark.) H., male, sixteen years old; perfectly well until October, 1909, when he was kicked in the back while playing football. A few days later a small

swelling appeared between rectum and coccyx; this grew rapidly; was supposed to be an abscess; operation and subsequent microscopical examination proved it to be round-celled sarcoma. Recurred almost immediately and within two months thousands of small subcutaneous tumors, varying in size from a shot to a pea, appeared in all parts of the body, together with internal metastases.

CASE XXV.—*Sarcoma of scapula (delayed)*. B. A., female, twenty-four years of age; family history negative. Seven years before the development of the tumor, while lying in a hammock, the latter broke down, causing her to fall; she struck with her shoulder-blade upon the bare floor; the injury was sufficient to cause her to faint, but she entirely recovered from it and there was no evidence of any tumor until six years later, when a hard swelling developed at the exact spot of the injury. This continued to grow rather rapidly and, on removal, proved to be angiosarcoma of periosteal origin.

CASE XXVI.—*Sarcoma of arm (immediately)*. Mrs. J. G., aged forty-three years; family history negative. At the age of seven, in an altercation with another girl, was struck upon the left arm. A tumor developed almost immediately. Operation; rapid recurrence, and eleven operations were successively performed within the next four years, the last one being an amputation at the shoulder-joint. I saw the patient in March, 1906, at which time she had been in perfect health for 32 years. A letter from Dr. Stephen Smith, who remembered the case distinctly, states that the disease was pronounced sarcoma.

CASE XXVII.—*Sarcoma of the right femur (acute)*. A. G., male, age fourteen years (May, 1908). Fell and injured right femur just above knee, January, 1908. Noticed bony swelling two or three weeks later. Grew with great rapidity. Three months later circumference of femur, site of tumor, measured 20 inches. Giant-celled tumor. Grew rapidly worse, causing death within six months.

CASE XXVIII.—*Periosteal round-celled sarcoma of the femur; acute traumatic malignancy*. M. M., age fifteen years (May 26, 1904); family history good. January 20, 1904, slipped and fell, striking on his left knee. No swelling noticed until three days later, when there appeared a hard swelling over the interior portion of the lower end of the femur, just above the joint. This slowly increased in size. For nine weeks he was treated

with bandages and splints. Rapid increase in size of tumor. Four months later the left femur showed a fusiform enlargement, beginning at the lower end and gradually shading off about seven inches above. Death within a year.

CASE XXIX.—*Periosteal sarcoma of the clavicle; acute traumatic malignancy.* J. L., age eight years (March, 1906); family history good. Had a bad fall from stone fence in October, 1905, injuring shoulder. A small lump appeared in the right clavicle a few days later. Grew with great rapidity. Tumor noticed in the right clavicle three to four weeks after injury. Operation, partial removal of tumor. Generalization. Death within five months.

CASE XXX.—*Sarcoma of the axilla and pectoral region (acute).* W. W., male, age fifty-eight years (August, 1909); family history, sister died of cancer of the womb. Fell through a barrel, striking the pectoral region against the sharp edge of the barrel, October, 1908. Had severe pain that night but no swelling or nodule. A day or two later noticed a small swelling which immediately began to increase in size. The following February, four months from time of injury, it became quite large and was removed by Dr. Matas, of New Orleans. Recurrence followed, and a second operation was performed May, 1909. Second recurrence promptly followed. Patient soon became inoperable.

CASE XXXI.—*Sarcoma of the testis; acute traumatic malignancy.* F. H., male, age twenty-seven years (July, 1898); farmer; family history good. Was perfectly well until two years ago was kicked in the testicle by a horse. Small lump appeared very soon after the injury and never disappeared. Did not increase in size until four months ago, when again injured by falling through a hay-rack, injuring the same testicle. Immediately after the old swelling of the testicle began to increase and continued very rapidly. Examination showed right testicle the size of a cocoanut. Testicle was removed. Proved to be round-celled sarcoma. Died one year later.

CASE XXXII.—*Acute traumatic sarcoma of the antrum.* A. Y., male, forty-one years old (February, 1902); family history good. February, 1901, was struck by the horn of a steer, causing a distinct bruise. The evidences of the bruise disappeared, but at the end of three weeks he began to have pain in superior maxilla, and a week later noticed a bony tissue on same side

FIG. 10.



Round- and spindle-celled sarcoma of superior maxilla. (Case XXXII.)

FIG. 11.



Round-celled sarcoma of breast. Acute traumatic malignancy. (Case XLI.)

FIG. 12.



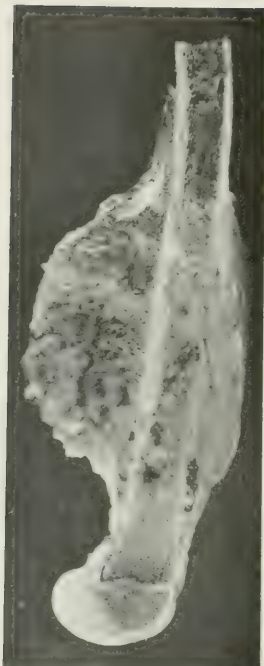
Traumatic sarcoma of femur following recent fracture of femur; direct blow from kick of horse. (Case XLIV.)

FIG. 13.



Acute traumatic malignancy three weeks after a kick.
(Case LV.)

FIG. 14.



Sarcoma of femur developing three weeks after kick.
Amputation, five weeks from date of injury. (Case LV.)

FIG. 15.



Shows condition 2½ months after removal of double carcinoma of breast, with very extensive axillary involvement. Patient gained 10 pounds. No swelling of arms. (Case LIX.)

FIG. 16.



Acute traumatic malignant carcinoma developing one month after having been struck on breast by a batted base ball. (Case LXII.)

which proved to be round- and spindle-celled sarcoma. Superior maxilla was removed by Dr. W., St. Paul, Minn., May, 1901. Diseased part could not be entirely removed. Growth continued to increase rapidly. General condition became rapidly worse. He was given only a few weeks to live. Entire disappearance of the tumor under 101 injections of the mixed toxins of erysipelas and *Bacillus prodigiosus* by the local physician, 1901. Marked improvement was quickly noted and continued steadily. Result, complete recovery. Died six years later from acute nephritis. Microscopical examination confirmed by Professors William H. Welch of Johns Hopkins and James Ewing of Cornell.

CASE XXXIII.—*Round-celled sarcoma of the testis; acute traumatic malignancy.* M. M., male, twenty-eight years of age (February, 1900); driver; family history good. Four weeks ago patient fell astride a bar and injured right testicle, no swelling noticed prior to this time. Swelling appeared very quickly, almost immediately after injury, and did not disappear. After a week or two began to increase in size. Two weeks ago patient went to Bellevue out-patient department and was tapped for supposed hydrocele; nothing but blood was found. I first examined him one month after the injury, and found the right testicle enlarged to the size of an orange. Believed to be sarcoma; two days later I removed the whole testis and cord up as far as the internal ring. Tumor appeared in the abdominal region, causing death five months from time of injury.

CASE XXXIV.—*Sarcoma of the back; acute traumatic malignancy.* Mrs. L. G., thirty-five years of age (November, 1902). October, 1901, while stooping under a heavy table, she rose suddenly and struck her back against the bevelled edge of the table. It hurt her so much the next day that she could not bend over. Three weeks later she noticed a hard lump at exact point of injury. It was removed, operation January 22, 1902, three months from time of injury. Tumor continued to grow rapidly. Several operations performed without checking the growth. Patient died from recurrence in the original place, and in the groin, in the early part of 1904.

CASE XXXV.—*Sarcoma of the left groin and inguinal glands; acute traumatic malignancy.* E. C. B., male, age twenty-one years (March, 1909). Struck in the left groin by a lever, Janu-

ary 15, 1908. Swelling appeared in the region at exact site of injury one week later. Increased rapidly in size. No pain. No evidences of inflammation. Two weeks after injury, tumor removed by Dr. Carson, Springfield, Mass. Microscopical examination showed it to be round-celled sarcoma. Recurrence shortly afterwards, involving the inguinal and iliac glands. Toxins were used; entire disappearance of tumor. Patient well in 2½ years.

CASE XXXVI.—*Osteochondrosarcoma of the ilium (acute)*. L. P., twenty-seven years old (Oct. 27, 1910). Fell while on roller-skates, November, 1906. A few days later noticed a swelling over the right ilium in the region of the injury. Greatly increased in size. October, 1910, four years later, whole ilium and upper portion of femur involved in enormous osteochondrosarcoma, measured 22 inches by 21.

CASE XXXVII.—*Sarcoma of the frontal sinus (acute)*. W. J. C., male, age forty-one years (October, 1906). Three years ago was struck in the left frontal region by a piece of iron weighing 1½ lbs., falling from a distance of 4½ ft. This blow immediately caused a swelling over the left eye near the hair line. Swelling never entirely disappeared. One month later began to increase in size, and continued to grow steadily up to date of my first observation, October, 1906. One year after injury there was a bulging of the left eye. Physical examination at that time showed an extensive inoperable osteosarcoma originating in the frontal bone, probably the frontal sinus.

CASE XXXVIII.—*Lymphosarcoma of small intestine (acute)*. Intra-abdominal sarcoma, result from associated trauma. P. G., male, age thirty-two years; family history good. Fell down elevator stairs April, 1901. He was unconscious. Had shooting pains in the abdomen immediately after injury. Perfectly well up to the time of injury. Noticed hard immovable mass in right groin two weeks later. Began to lose weight at this time. Exploratory operation six weeks after injury, by Dr. Weir, Roosevelt Hospital. Diagnosis, lymphosarcoma of the small intestine. When I examined him, June 21, 1901, less than a month later, tumor had increased greatly in size and had involved the abdominal wall extending from the umbilicus to Poupart's ligament.

CASE XXXIX.—*Medullary carcinoma of appendix, cæcum, and ilium*. Miss D., fifty years of age. In March, 1907, fell

and injured the right ilium; considerable pain followed shortly afterward, which gradually increased. First operation three months later; second operation (both by Dr. W. G. Young of Grand Rapids), Nov. 9, 1907. A portion of the tumor was microscopically examined and proved to be medullary carcinoma. Third operation done by myself in February, 1908; primary growth found to be in the cæcum and appendix.

CASE XL.—*Sarcoma of the breast (acute)*. A. M., female, age thirty-one years (August, 1896); family history good. The patient had always been in perfect health until August, 1896, when she received a blow upon the right breast. A few days later she noticed a lump at exactly the site of injury. This grew rapidly, but it was not painful until November. In December, 1896, it became exceedingly painful and was growing very rapidly. She consulted a physician, who advised internal treatment. On February 8, 1897, I saw her in consultation with Dr. William T. Bull. At this time the entire right breast was occupied by a spheroidal tumor about the size of a large cocoanut, markedly protuberant, slightly fixed to the chest wall, not involving the axillary glands. The skin was thin and glossy, and of a deep purple color over the most protuberant parts. The tumor grew with enormous rapidity and soon began to slough. The patient died of exhaustion in April, 1897, or seven months after the receipt of injury.

CASE XLI.—*Sarcoma of the breast (acute)*. M. M., female, age thirty-one years (February 6, 1897); unmarried; family history good. Struck her breast against an iron bracket while acting as a clerk in a dry-goods store. She noticed a swelling immediately after the injury, and this continued to increase in size. Five months later the tumor was removed by operation, recurrence quickly following; four months from the first, a second operation was performed. The patient died eighteen months after the injury, from a supposed recurrence in the brain, five operations having been performed in the mean-time. This case was operated upon by Dr. B. Gallaudet and Dr. W. T. Bull; it was not seen personally by myself.

CASE XLII.—*Osteosarcoma of the ribs (delayed)*. G. V., sixty-two years of age (January 19, 1910); male. Family history, father died of sarcoma of the tibia. A year and a half ago while trimming hedges he fell upon the sharp point of shears which ran into the tenth rib on the left side about the mammillary

line, causing a fracture. There was marked ecchymosis over this area at the time. Last August a small portion of projecting rib was removed. Microscopical examination, negative. Three months ago he developed a large mass in the axillary line a little above the site of the injury, right over the contused area. Patient lost 10 lbs. in weight. Has increasing weakness and rapid heart action the last few weeks. Gets out of breath very easily. Slightly cachectic in appearance. No tumor. Pulse has been running about 120. Physical examination shows a slight bulging of the chest wall, from the nipple nearly down to the costal arch, with complete dulness over the area. Fluoroscopic examination is stated by the physician to have shown a dark mass the size of a fist in this region.

CASE XLIII.—*Small round-celled sarcoma of the back (acute)*. N. J., male, eight years of age. In the latter part of August, 1901, fell from stoop, striking upon his back. Two to three weeks later, mother noticed a swelling in the left scapular region (the point where he struck), which increased rapidly in size and was soft and fluctuating almost from the start. Four weeks thereafter he was referred to me by Dr. Polhemus of Nyack, N. Y. Physical examination showed a cystic swelling, the size of an orange, in the left scapular region; fluctuation well marked. Diagnosis of hæmatoma was rendered. Under ether an incision was made and a large amount of dark bluish fluid was removed with a trocar. Three weeks later the fluid returned, and there was evidence of a solid tumor in addition to the fluid. A second operation was performed under ether, and a new growth was found which, on microscopical examination by H. T. Brooks, Professor of Pathology, proved to be round-celled sarcoma. It was impossible, in view of the large area occupied by the tumor, to make a thorough removal. The patient was put upon the X-ray treatment shortly after the second operation. Under four months' treatment the growth had apparently disappeared. However, three weeks later it recurred and finally disappeared under the mixed toxins. The boy is perfectly well at present, nine years later.

CASE XLIV.—*Sarcoma of the femur, following fracture*. T. H. B., male, forty-five years of age; blacksmith. January 20, 1900, received a fracture of the lower third of the right femur, caused by the kick of a horse; produced no lesion of skin; good union apparently followed; treated by weights for six weeks.

with apparently good result. About eight weeks after the injury, noticed what seemed to be callus increasing in size; this continued to grow larger and soon became painful. Within six months it had become the size of a child's head; I performed amputation; it proved to be an osteosarcoma which had occurred at the exact site of the fracture.

CASE XLV.—*Sarcoma of tibia*. S. F., female, forty-six years of age; had a fall in December, 1909; tumor developed almost immediately afterward.

CASE XLVI.—*Sarcoma of the femur (acute)*. C. L., female, thirteen years of age. Had a fall in June, 1906. She had a little pain afterward, but a swelling was not noticed until two weeks after the injury, when there was found a small tumor in the lower inner portion of the right femur just above the knee. On August 13, 1906, she was admitted to the Hospital for Ruptured and Crippled. At that time the lower third of the femur was much enlarged and the entire bone was involved by a periosteal growth. Exploratory operation showed it to be an osteosarcoma. Amputation below the trochanter was done a few days later by Dr. Royal Whitman. She was put upon the mixed toxins as soon as the wound had healed. The toxins were continued until January 15, 1907. She regained her normal weight and was well 3½ years after.²

CASE XLVII.—*Sarcoma of the tibia* (Jan. 29, 1908). T. L., male, aged eleven months. December 20, 1907, or five weeks ago, while the baby was nursing, a two-year-old child seized his right leg and nearly pulled him to the floor, twisting the leg but causing no external bruise. Three days later the mother noticed a swelling in the middle of the right leg apparently connected with the tibia. Three days later she consulted a physician, who stated that it amounted to nothing. Two to three days afterward, she again called a physician who, this time, said it was a sprain and applied a splint. December 30, the child was brought to the Hospital for Ruptured and Crippled and examined by Dr. H. L. Taylor, who put the leg up in a plaster cast and the mother was told to return in one week. At the end of the week the cast was re-applied and the child was sent to another hospital for admission, as an indoor patient. The mother was unable to

²I have just learned that she has just died of metastases which developed four years after operation.

get the child admitted for more than two weeks, during which time the swelling of the leg increased very rapidly, the inguinal glands also became much enlarged and, at the end of three weeks, extensive hemorrhages appeared in the right eye and a little later in the left eye.

The patient was brought to me on January 29, 1908, or five weeks after the receipt of the injury. Physical examination showed a tumor involving nearly all of the right tibia, apparently the fibula as well, reaching nearly from the ankle to the knee; skin was movable, but of a purplish color due to dilated veins. The glands in the groin were markedly enlarged; both eyes showed evidence of extensive hemorrhage into the surrounding tissues; sight not impaired; slight exophthalmus. The child's general condition was so bad that the mother did not think he would be able to stand the journey from Brooklyn. The child was immediately admitted to the Nursery and Child's Hospital and the toxins were begun in one-tenth minim doses, with no reaction until the third dose, which was followed by a very slight reaction. The child failed very rapidly and died February 2, 1908. Such minute doses of the toxins as were given, with practically no reaction, doubtless had little influence in hastening the death. No autopsy was permitted. In the absence of a microscopical examination, it is impossible to say absolutely that the trouble was sarcoma, but the clinical features and the absence of temperature or any symptoms pointing to inflammatory trouble make the diagnosis practically certain.

CASE XLVIII.—*Sarcoma of the humerus (delayed)*. R. G. H., male, forty-six years old. Amputation of thigh for sarcoma of tibia. Six years later fell, striking his right shoulder against an iron bed. Four weeks thereafter he began to have pain in the region of the right deltoid; was treated for rheumatism for nearly a year, when a bony swelling became apparent, which gradually developed into an enormous osteosarcoma. This was removed by amputation of right shoulder-joint.

CASE XLIX.—*Sarcoma of fibula*. Mrs. R., thirty-four years of age. Kicked by a horse in the upper portion of the right fibula, thirteen years ago. Almost immediately afterward, there developed a small bony tumor which was regarded as an osteoma. There was very little increase in size for thirteen years. In the spring of 1910 it began to grow rapidly, and within a few months

became 4-5 inches in diameter. September 25, 1910, removal of entire fibula. The tumor proved to be a spindle-celled sarcoma.

CASE L.—*Osteosarcoma of left humerus*. I. H., male, eighteen years of age; bricklayer. Fell three stories, striking a glancing blow in the region of the right humerus. Pain set in four months later and swelling quickly followed. Operation; recurrence in other humerus.

CASE LI.—*Sarcoma of rectus muscle (acute)*. J. O. C., eleven years of age, male. Received a blow upon the abdomen just above the umbilicus in the summer of 1909. Two to three weeks later noticed hard lump in the right rectus muscle, just above umbilicus. January, 1909, operation at the Hospital for Ruptured and Crippled. Microscopical examination by Dr. Jeffries, Pathologist of the hospital and Professor of Pathology at the N. Y. Polyclinic, showed it to be a mixed-celled sarcoma; the report stated "for quite a distance beyond the growth proper, the muscle is being invaded by the sarcoma cells which follow accurately all the ramifications of the areolar interstitium."

CASE LII.—*Sarcoma of clavicle*. W. F., male, thirty-eight years old. In December, 1905, while swinging from a trolley car, he grasped the rail with the left hand and received a severe sprain of shoulder. He immediately began to have severe pain over the inner third of the clavicle which, however, subsided somewhat under massage. One week later he noticed a bony lump in the clavicle, which increased rapidly in size. It proved to be a round-celled periosteal sarcoma.

CASE LIII.—*Sarcoma of right thigh (delayed)*. Mrs. G., fifty-eight years of age (September, 1910). Three years ago struck her right thigh against corner of bedstead in the dark. A small lump developed 2-3 weeks later. There was very little change in size for two years, when she fell on a chair, badly bruising the tumor. It immediately became very painful and at once began to grow rapidly. Operation, but tumor recurred within three weeks.

CASE LIV.—*Sarcoma of the femur—trauma (delayed)*. W. S., male, age sixteen years (January 8, 1910); family history negative. Always had strong vigorous health until September, 1909, when he was injured while playing football. After he had fallen, another boy fell upon him, injuring his left hip in the

region of the trochanter. He complained so much of it, that a physician was called in, but he found only a contusion. All evidences of this entirely disappeared, but in the following June, or nine months after the injury, he began to have so-called rheumatic pains in the region of the injured hip. He was treated for rheumatism until September, 1910, when he consulted Dr. Fraser of Philadelphia, who found an inoperable osteosarcoma of the femur at the site of the injury. At the present time, January, 1911, the patient's condition is hopeless.

CASE LV.—*Sarcoma of the femur; acute traumatic malignancy.* J. A., male, twelve years of age (January, 1907). Perfectly well until three weeks ago, while coming home from school was kicked by another boy, in the right side of the femur just above the knee. He came home crying and mother carefully examined him but found no swelling at this time. One week later he complained of having pain in the injured region. Mother again examined him and found a hard, irregular swelling, about three inches above the knee, not movable. This rapidly increased in size, and January, 1907, three weeks after injury, he was admitted to the Hospital for Ruptured and Crippled. Photograph then showed acute form of swelling. Physical examination showed a tumor of hard consistence, apparently periosteal, involving the right femur, beginning about 2 inches above the upper border of the patella and extending $4\frac{1}{2}$ inches upwards. Mixed toxins were used and the tumor slightly diminished in size; amputation immediately followed. Local recurrence. Death resulted four months from date of injury. Here we have one of the most striking examples of acute traumatic malignancy, a definite history of a single trauma localized. Careful examination shows swelling to have developed one week after injury, running a most rapid course, and causing death within four months.

CASE LVI.—*Sarcoma of the femur; acute traumatic malignancy.* E. D., male, aged twelve years; family history negative. Personal history: always in good health up to September, 1906, when he fell from the limb of a tree about six feet high. Three weeks later he began to have pain in the right upper femur; this continued, slowly getting more severe, until October, when he consulted a physician who treated him for rheumatism. In

January, 1907, he noticed a swelling in the upper part of the right femur which increased very rapidly in size and there was marked deterioration in general health. I first saw the patient on the 28th of March, 1907. The tumor continued to increase rapidly in size and caused death a few months later.

CASE LVII.—*Sarcoma of the radius; trauma.* M. F., female, twenty-six years of age; family history negative. Several years ago fell and injured left wrist. In the spring of 1908 tripped and fell, injuring the same wrist. Examination by her family physician showed a fracture of the wrist. Two weeks later she went to the New York Hospital and X-ray examination showed disease of the bone, probably sarcoma. On May 1, an operation was performed by Drs. Pool and Stewart; a central sarcoma was found and curetted out on either side. On May 18, there was no evidence of union and amputation was advised, but refused. The patient then came under my care for the treatment with the mixed toxins. After six weeks' treatment perfect union had occurred and the patient was well one year later.

CASE LVIII.—*Sarcoma of the femur; acute traumatic malignancy.* Male, age thirty-five years (March, 1907); family history good. Kicked by a horse in the middle of the left thigh about six weeks ago. Patient admitted to Bellevue Hospital, February, 1907. Tumor developed in size very rapidly in a few days, occupying two-thirds of the thigh, apparently connected with the bone. The development of the tumor was so rapid that it was not regarded by the attending surgeons as sarcoma, until a portion was removed and microscopical examination showed it to be chondrosarcoma. Entire tumor had developed within six weeks.

CASES OF CARCINOMA OF BREAST, ASSOCIATED WITH ANTECEDENT INJURY.

CASE LIX.—*Carcinoma of both breasts (acute).* E. D., single; thirty-three years of age; family history good. Always well up to 1899, when she was run into by a tandem bicycle and thrown violently forward upon the pavement, striking upon her chest and bruising both breasts. Two to three weeks after the injury she first noticed a small lump in the right breast, which slowly increased in size. Two years later a similar lump ap-

peared in the left breast. From this time on both tumors grew very rapidly. The patient was referred to me by Dr. W. H. Carmalt, of New Haven, in September, 1902, who regarded the case as inoperable. The tumor in the right breast was the size of two fists and ulcerated; that of the left breast, nearly as large. Removal of both breasts; proved to be carcinoma; recurred in spite of immediate X-ray treatment after operation and proved fatal within six months.

CASE LX.—*Carcinoma of the breast; trauma.* A. M., female; single; age fifty years (August, 1906); family history good. Fell and struck right breast on the corner of a dresser short time before appearance of tumor. Two or three weeks later noticed a small hard lump on same breast, site of injury. Six months later breast was removed by operation. Proved to be carcinoma. X-ray begun two weeks after operation, continued for forty-five consecutive days. Seven months later whole right breast invaded with rapid growing, infiltrating carcinoma.

CASE LXI.—*Carcinoma of breast; acute traumatic malignancy.* M. M., female; age forty-six years (April 23, 1904). May, 1903, was struck in left breast by a baseball, thrown 100 ft. Caused a bruise, but noticed no tumor until five months later in exact region of injury, a small hard lump appeared. Grew with great rapidity. Examination April, 1904, showed entire breast involved in typical carcinoma. Tumor extensive; skin as well as pleural involvement.

CASE LXII.—*Carcinoma of the breast (trauma).* Mrs. A. M., thirty-seven years of age (October, 1901); family history good. Patient always well until a year ago when she was struck in the upper part of the left breast by a batted baseball, so severely that it knocked her down. Some pain felt in bruised area, left part of breast. One month later on exact site of injury, a hard lump appeared which continued to increase in size. October 20, 1901, I examined her and found the left breast of enormous size, almost entirely infiltrated, typical carcinoma. Tumor involving glands, skin, and pectoral region. Patient was hopelessly inoperable.

CASE LXIII.—*Carcinoma of breast (delayed).* Miss E. J. D., thirty-nine years of age; single. Had worn a plaster jacket or aluminum corset for lateral curvature of spine following infantile paralysis since she was five years of age. Four years

ago, cancer of the right breast developed; one year later, of the left breast.

CASE LXIV.—*Carcinoma of breast (delayed)*. Mrs. J. W. C., forty-three years old (October, 1895). Two years ago struck by a tennis ball in left breast, causing her to faint. One year later noticed a small tumor at the exact point of injury, which proved to be carcinoma.

CASE LXV.—*Carcinoma of breast*. S. B., female, fifty-three years of age (January, 1896). Received a blow from a broom-handle in the right breast. Six months later a hard tumor developed at the exact point of injury, which proved to be a carcinoma.

CASE LXVI.—*Carcinoma of breast*. Mrs. D. P. C., fifty-two years of age (November, 1901). Kicked in the right breast by a child two years before.

CASE LXVII.—*Double simultaneous carcinoma of breast*. Mrs. N. A. B., forty-three years old (October, 1909). (Mother has carcinoma of breast at the same time, developing almost immediately after having fallen down the cellar stairs and injured the breast.) Seven years ago the patient was caught in the iron gate of an elevated train, severely bruising both breasts, causing them both to become black and blue. Six years later, noticed retraction of the nipple in the left breast with a slight exudation. Three weeks later, noticed a similar condition in the other breast. No distinct tumor noticed until September, 1908. I first saw the patient in May, 1909, when both breasts were extensively involved as well as the glands in both axillæ (medullary carcinoma).

CASE LXVIII.—*Carcinoma of the breast (delayed)*. Mrs. L. P., fifty-nine years of age (March, 1906). Fell, striking right breast on the back of a chair when young woman. A small tumor developed immediately at the site of injury. This grew very slowly and remained practically quiescent until twelve years ago when it was removed by operation. It recurred ten years later and finally caused death.

CASE LXIX.—*Cancer of breast (delayed)*. B. S., single, seventy years of age (1905); family history good. Perfectly well until August, 1905, when she struck the right breast against an iron bed post, causing a black and blue area. A few months later noticed a hard lump at the exact point of injury. Six

months later I removed her breast and axillary glands for carcinoma. The disease recurred within one year and caused death.

CASE LXX.—*Cancer of breast.* Mrs. W. D., fifty-nine years of age (September, 1902); family history negative. Ran against a hard object, striking upon the left breast, causing it to become black and blue. No lump was noticed until two months later. This increased rather rapidly in size and eight months later had reached the size of a goose-egg. Operation; recurrence; death.

CASE LXXI.—*Carcinoma of breast.* Mrs. H. C. L. (October, 1903); family history negative. Well until three years ago, when she was struck upon the upper part of the left breast by a boy, in play. No tumor noticed until two years later, but she stated it was exactly the same spot where the injury was received; grew slowly; first operation June, 1902; tumor pronounced adenoma; local recurrence 1903 with extension to other parts; typical carcinoma.

CASE LXXII.—*Carcinoma of the breast.* Mrs. C. S., colored, forty years of age (September, 1896); family history good. Received a blow on right breast three years ago. One and a half years later she noticed a lump on exact site of injury. This increased slowly since. Operation November 18, 1896; entire breast removed; recurrence.

CASE LXXIII.—*Carcinoma of the breast.* Mrs. C. S., widow, farmer's wife, sixty-three years of age (March, 1896); family history good. Three years ago injured her right breast while carrying a bundle of poles in her right arm. Six months later noticed small lump on the right breast, exact point of injury. I removed entire breast and axillary glands which were involved nearly up to the clavicle.

CASE LXXIV.—*Carcinoma of the breast (trauma).* Miss R. P., single, sixty-five years of age (August, 1903); family history good. Injured left breast falling against trolley car, 1902. One month later noticed depression in the skin. Two months later small tumor developed in this place. August, 1903, ten months from date of injury, examination showed tumor of the left breast with characteristic orange-peel appearance. Death followed recurrence one year later.

CASE LXXV.—*Carcinoma of the breast (trauma).* Mrs. K. R., age thirty-seven years (April, 1898); family history good.

Struck her right breast against a bedstead October, 1897. A few weeks later there began to be a reddish discharge from the nipple, followed by the appearance of a hard lump on site of injury. Examination, 1898, six months from time of injury, shows right breast the size of two fists. Skin infiltrated. Typical carcinoma.

CASE LXXVI.—*Carcinoma of the breast; acute traumatic malignancy.* Mrs. T., age forty-two (1895); family history good. 1892, suffered a severe blow on the left breast. A few weeks after a hard tumor was noticed in the region of injury. First operation, May, 1893, whole breast removed and examination showed growth to be scirrhus carcinoma. Recurrence, February, 1895. Beyond operation.

CASE LXXVII.—*Carcinoma of the breast.* Mrs. I. S., thirty-nine years of age (August, 1909); family history good. She ran against the corner of a shelf, injuring the right breast. Six months later a lump developed on exact point of injury. Operation two years later, recurrence followed within a few weeks. When seen by the writer, August, 1909, she had a large inoperable carcinoma of the left breast and axillary glands.

CASE LXXVIII.—*Carcinoma of the breast.* Mrs. A. R., thirty-nine years of age (December, 1902); family history good. Struck right breast against projecting nail in the wall two years ago, causing pain for two or three days, but no tumor appeared until one year later, when she noticed a small hard lump about the size of a hickory nut on exact point where injury had been received. This grew to be the size of a goose egg in about three months. Operation was performed and microscopical examination proved it to be carcinoma. Operation six months later and recurrence in four months, December, 1902.

CASE LXXIX.—*Cancer of breast (trauma).* Sister M., sixty years of age (October, 1898). February, 1908, suffered severe blow, right breast, from patient in the hospital. At once said that she felt sure she would get cancer from injury. No lump, however, was noticed until early in April, just two months after injury. This grew rapidly. September of same year, whole breast and axillary glands extensively involved. Condition hopeless.

CASE LXXX.—*Cancer of breast (trauma).* Mrs. M. McC., age fifty-seven years (January, 1905); family history good. Two years ago injured right breast by knocking against bedstead. About two months later, small nodule appeared at site of injury,

grew slowly. Breast removed a year later, October, 1904, by operation. Hopeless recurrence within three months of operation.

CASE LXXXI.—*Carcinoma of the breast resulting from continued irritation.* Mrs. K., thirty-three years of age (May, 1905); family history: uncle died of cancer of ribs as a result of fall. Patient stout, full bust. Two months prior to the development of the tumor she changed her habit of wearing a high corset to a low one, upper edge of which pressed against the breast and soon caused an irritation two inches to the right of the left nipple. Two months, beginning from date of wearing the corset, she noticed a small encapsulated nodule at the point of irritation about the size of a hazel-nut. At the end of four months Dr. Parham removed a small nodule which after microscopical examination was pronounced non-malignant. In spite of this, there appeared shortly after a rapidly increasing brawny infiltration, starting in the region of the tumor and extending over the whole anterior thorax, from the clavicle down to the costal arch and outwards beyond the axillary line. Glands in axilla became quickly involved. Within six months from time she first noticed tumor the right side of thorax anteriorly from the sternum to the midaxillary line, and from the clavicle nearly to the costal arch was occupied by an enormous infiltrating growth attached to the chest wall. Patient died a few weeks later.

CASE LXXXII.—*Carcinoma of breast (delayed).* Mrs. N. C., thirty-eight years old; family history good. In May, 1910, struck her right breast against a sharp corner of an ice-box. Is sure she had no lump in the breast previous to the injury and none after same, until three months later. She then noticed a small hard lump at the exact site of the injury. This was partly removed under cocaine at Bellevue Hospital and proved to be a colloid carcinoma. Entire breast and axillary glands removed by myself November 28, 1910, at the Rockefeller Hospital.

CASE LXXXIII.—*Cancer of the breast (acute).* Miss E. B. W., thirty years (1905); no heredity; no previous inflammation of breast; kicked in breast by a two-year-old child, causing a black and blue area; very painful for two days. One month later noticed a lump in exactly the same place. Eight months later consulted a physician who found a tumor the size of a hickory nut. Operation shortly afterward, proved it to be carcinoma; recurred and caused death in two and a half years from the time of the injury.

CASE LXXXIV.—*Cancer of the breast.* J. C. W. (February, 1907); family history good. In September, 1905, fell and struck right breast severely against the sharp corner of a wooden box. Breast became swollen and very painful. No tumor found at the time of the injury. The next day a swelling was noticed which slowly increased in size, and six months later the breast was removed by operation together with the axillary glands. It proved to be carcinoma; recurrence; death.

CASE LXXXV.—*Carcinoma of breast (hereditary).* Mrs. D. W., aged fifty-five years, gives following family history: Mother died of cancer of the stomach, the symptoms of which developed shortly after she was thrown from a carriage, injuring her abdomen, and her physician stated that the injury caused the tumor. An aunt died of internal cancer; one sister died of cancer of the breast at the age of thirty-eight years, the cancer developing very shortly after a blow; breast removed by Dr. Cheever, of Boston; recurred and proved fatal two years from the time of the injury. Another sister died of abdominal cancer which developed shortly after a blow upon the abdomen.

CASE LXXXVI.—*Carcinoma of male breast.* G. H., laborer, age sixty-four years (April, 1906). Family history: sister died of cancer of stomach. Injured left breast near nipple twelve years ago. Six months later noticed a small lump the size of a pea, hard and immovable, at exact site of injury. Slowly increased in size for six years. Plaster was applied 6 years ago. Tumor gradually increased in size. April 16, 1906, physical examination shows large typical carcinoma 2 x 3 inches in diameter, ulcerated. There are over entire extent several hard granular tumors in the axilla and one or two hard glands above the clavicle on the left side.

CASE LXXXVII.—*Carcinoma of the breast (acute).* Mrs. O. B., forty-five years of age (March, 1904), received a blow in the right breast from the elbow of a child, two years ago. Noticed a lump at the site of the injury a few weeks later.

CASE LXXXVIII.—*Carcinoma of the vagina.* S. F., age twenty-five years, married, one child, seven and a half months old. Patient states that she was badly torn at child-birth; began to have trouble shortly afterward. Four months later consulted a physician who stated she had a new growth in the vagina; had two slight operations. At my examination, October, 1908, seven and a half months from the time of child-birth, the entire

vagina was filled with an enormous carcinoma, infiltrating vagina and rectum. Condition hopeless.

CASE LXXXIX.—*Carcinoma of the breast.* Mrs. E. B., age thirty-nine years (February 26, 1907). Family history: mother died of cancer of the breast. Patient injured right breast in March, 1906, by running against the corner of a table. A lump appeared a few days afterward, at the exact site of injury. This grew rapidly in size and an operation was performed at Dr. Mayo's hospital on October 22, 1906. Disease returned in about three months locally and apparently in pleura and lung.

CASE XC.—*Carcinoma of the breast.* Mrs. W. P., age seventy years (1906). Family history: aunt, mother, brother and sister all died of cancer. Personal history: Six years ago received an injury to the right breast, caused by hitting against a wall. A month later she struck the same breast against an iron faucet. Very shortly after second injury, a lump was noticed at the exact site of injury. This grew rapidly in size, and she had it examined by Dr. Robert Abbe, who pronounced it carcinoma. She refused operation, and the tumor was finally removed by plaster. Patient examined by myself five years later, and found free from any recurrence. This case had no microscopical examination of the original tumor.

CASE XCI.—*Carcinoma of the breast.* Mrs. G. H. C., age fifty-four years (March, 1908); family history good. Husband had epithelioma of lip which existed ten years before operation was performed. Two and a half years ago, patient slipped on a rug and fell heavily to the floor, striking the right thumb against the right breast, so severely that it caused dislocation of the thumb. A few weeks (less than a month) afterward, a tumor developed at the upper and inner side of the breast at exact site of injury. Finally, six months after, breast and axillary glands were removed by a very extensive operation. A few weeks after operation there appeared a reddish colored thickening along the whole cicatrix accompanied by œdema of the arm. Examination, March, 1908, showed very extensive local recurrence with metastasis in the lung and pleura.

CASE XCII.—*Carcinoma of the breast.* A. C., age forty-three years (July, 1908); family history good. April 15, 1908, struck left breast a hard blow against a blunt piece of wood which caused no swelling at the time. About two or three weeks later she noticed a lump in the exact site of injury which grew

very rapidly. Physical examination, July 20, 1908, showed left breast occupied by an infiltrating tumor involving the whole central portion of the breast, very hard in consistence; skin adherent. No axillary glands involved. Clinical diagnosis of carcinoma beyond question.

CASE XCIII.—*Carcinoma of breast.* Mrs. E. T. A., age sixty-two years (October 21, 1895); married; no children. Five years ago fell and struck breast, causing a distinct bruise. One year later a tumor developed in site of injury, which rapidly increased in size till it was as large as an orange. Breast was removed, and proved to be carcinoma. I saw the patient October 21, 1895, with inoperable recurrent carcinoma. Operation and left breast removed. Microscopical examination proved it to be carcinoma of breast.

CASE XCIV.—*Carcinoma of breast.* Miss L. B., age forty-five years (1897). Mother died of cancer of breast. Four years ago received an injury by running against sharp corner of a banister and striking her breast. No tumor appeared at site of injury, until one year later. In 1897 I removed the breast and axillary glands. Tumor proved to be carcinoma. Extensive involvement of axillary glands. Part removed for microscopical examination proved to be carcinoma.

CASE XCV.—*Carcinoma of breast.* Mrs. N. F. B., age thirty-eight years (February 14, 1896); family history good. Four years ago, October 4, she fell and injured right breast. Tumor appeared a few weeks afterward. First operation 1894, partial excision of the breast by another surgeon; axillary glands not removed. Tumor recurred within the latter part of the year. Extensive involvement of axillary glands. I performed an operation February, 1895, but was unable to remove entire disease. Patient was put upon the mixed toxins of erysipelas and *Bacillus prodigiosus* with the hope of retarding the progress of disease. Died of abdominal metastasis.

CONCLUSIONS.

A careful study of the evidence here presented, based upon over 1200 personal observations, justifies, I believe, the following conclusions:

1. Local trauma of any kind, from chronic irritation to a single local contusion, is not infrequently the direct exciting cause of malignant tumors of all types.

2. That a single local injury may cause a carcinoma as well as a sarcoma, is no longer open to speculation. The cases that I have submitted fulfil all the conditions necessary to establish a definite causal relationship between a single trauma and the development of a cancer.

3. This relationship in no way depends upon our ability to offer a scientific explanation of it; nor does it depend upon the acceptance of any one of the various hypotheses as to the etiology of cancer. It can be equally well explained whether we accept the extrinsic or intrinsic origin of malignant tumors.

4. Medicolegal side: The medicolegal aspect of this question is as yet in a most unsettled state. While we must admit that trauma often plays an important causative rôle in the formation of malignant tumors, this relationship must be clearly and definitely established according to principles and conditions very similar to, if not quite so exacting as, those laid down by Segond, before any legal liability can be admitted.

The following bibliography contains only a few of the more important references. For a more complete bibliography prior to 1894 cf. Löwenthal (*Arch. für klin. Chir.*, 1894-1895, Bd. xlix).

BIBLIOGRAPHY.

- Balthazar: *Precis de medecine legale*. Paris, 1906 (J. B. Bailliere, editeur).
- Baumeister: *Sur l'etiologie traumatique des tumeurs*, dissertation de Wurtzbourg, 1905 (travail surtout consacre a l'etude des cheloides et de leur degeneration cancéreuse).
- Becker: *Les accidents du travail*, 1903. Traduit d'après la 4^e édition allemande, par Gallez et Moreau. Bruxelles (H. Lamertin, editeur).
- Berger: *De l'influence des maladies constitutionnelles sur la marche des lésions traumatiques*. Th. d'agr. Paris, 1875.
- Boas: *Deutsche med. Wochen.*, 1897.
- Carrel: *Journal of the American Medical Assn.*, Nov. 12, 1910.
- Chevassu: *Tumeurs du testicule*, Th. de Paris, 1905-1906.
- Coley: *Influence of Injury upon the Development of Sarcoma*, *ANNALS OF SURGERY*, March, 1898.
- Delbet (Pierre): *Article Neoplasmes*. In *Traite de chirurgie de Le Dentu et P. Delbet*, t. I., p. 393 et suivantes. Paris, 1896.
- Dorson: *Travail a consulter a propos de la degeneration maligne des naevi*, Th. Doct., Montpellier, 1899-1900.
- Duplay et Cazin: *Les tumeurs*. Paris (Octave Doin, editeur).
- Favet: *Travail base sur un memoire d'Estlander et consacre a l'influence*

- du traumatisme sur le developpement des tumeurs malignes du sein chez la femme. Th. Doct., Paris, 1881.
- Flitner: Travail contenant 11 observations de sarcomes des membres d'origine traumatique, d'après l'auteur. Dissertation de Halle, 1896.
- Forgue et Jeanbrau: Guide pratique du medecin dans les accidents du travail. Paris, 1905 (Masson, editeur).
- Gerne, Didier and Jeanne of Rouen: Le Normandie Medicale, Dec. 15, 1906.
- Grassmann: Origine traumatique des sarcomes du testicule. Dissertation de Munich, 1900.
- Gross: Sarcoma of the Long Bones, American Journal of the Medical Sciences, 1879. (In the important statistics given by the author, traumatism is stated to have occurred 63 times in 144 cases of sarcoma.)
- Hechinger: Sur l'origine traumatique des sarcomes. Dissertation de Munich, 1903.
- Heldt: De l'origine traumatique des tumeurs, avec un cas de myelome traumatique. Dissertation de Munich, 1902.
- Herzfeld: Trauma und Tumor Vortrag auf dem 6. Verbandstage deutscher Eisenbahnärzte zu Metz, 1904.
- Kallionzis: Etude sur les relations des traumatismes et des contusions avec les neoplasmes. Athenes, 1898.
- Kempf: Releve de 1767 tumeurs, observees a Göttingen (l'origine traumatique est vraisemblable pour 21 d'entre elles). Dissertation de Gottingen, 1900.
- Kirchner: Ein Fall von Sarcom des Oberschenkels nebst statistischen Bemerkungen über Sarcom der Weichtheile. I. D. München., 1885.
- Laskowitz: Carcinome du testicule apres un traumatisme. Dissertation de Munich, 1905.
- Le Clerc: Contusions et neoplasmes. Th. Doct., Paris, 1883.
- Lecene: Article Tumeurs. Extrait du Precis de Pathologie chirurgicale en preparation a la librairie Masson et Cie. Paris, 1907.
- Lengnick: Deutsche Zeitschrift für Chirurgie, 1899, t. lii, p. 379 a 396.
- Liebe: Travail contenant 119 observations de sarcomes survenus apres un traumatisme. Th. Doct., Strasbourg, 1881.
- Lockwood: Lancet, Aug. 13, 1910.
- Loewenstein: Rappaort etiologique entre un traumatisme unique et le sarcome. Beitrage zur klin. Chir., 1906, vol. xlviii, p. 780 a 824 (Etude d'ensemble complete et analyse de 3 observations recueillies dans la litterature).
- Löwenenthal: Origine traumatique des neoplasmes. Arch. für klin. Chir., 1894-1895, Bd. xlix (Travail base sur une statistique de 800 cas, dont 137 cancers du sein resultant, au dire des malades, d'un traumatisme anterieur).
- Machol: Developpement de tumeurs a la suite d'accidents. Th. Doct., Strasbourg, 1900.
- Menetrier: Article Tumeurs. In Traite de pathologie generale de Bouchard, t. iii, 2 partie, p. 723 et suivantes. Paris, 1900.
- Moller: Travail consacre a l'etude des tumeurs et notamment des sar-

- comes developpes sur le cal des fractures. Dissertation de Wurtzbourg, 1902.
- Moser: Trauma und Carcinom. Aertz. Sach. Zeit., 1903 (Cite par Olive).
L'auteur s'est adresse a 12 corporations et leur a demande de lui indiquer tous les cas de carcinomes post-traumatiques observes par elles, pendant les 6 dernieres annees. Sur des milliers d'accidents, que ces corporations ont a indemniser annuellement, il n'a pu trouver que 15 fois le cancer.
- Ollive et Le Meignan: Accidents du travail, medecine legale, jurisprudence, p. 190 a 197. Paris, 1904 (Rudeval, editeur).
- Phelps: ANNALS OF SURGERY, May, 1910.
- Potel (de Lille): Introduction a l'etude de la Chirurgie. Paris, 1907 (Doin, editeur).
- Quenu: Article Tumeurs. Un Traite de Chirurgie de Duplay et Reclus, 2 edition, t. 1, p. 325 et suivantes. Paris, 1907.
- Raffaele: Il medico ed il giudice nella lege sugli infortuni del lavoro. Naples, 1901 (Nic. Jovene, editeur).
- Ribbert: In wie weit können Neubildungen auf traumat. Einflüsse zurückgeführt werden. Aertz. Sach. Zeitung, 1898, nos. 19 and 20.
- Roger: Introduction a l'etude de la medecine. 2^e edition, p. 385. Paris, 1904.
- Röpke: Habilitationsschrift, 1905. Monat. fur Unfallheilkunde, 1906, n. 3. p. 89.
- Sand: La simulation et l'interpretation des accidents du travail. Bruxelles, 1907 (Lamertin, editeur).
- Sandhövel: Ueber den Einfluss von Traumen auf die Entstehung maligner Tumoren. In.-Diss. Bonn., 1900.
- Schöppler: Einmaliges Trauma and Carcinom, Zeitschrift f. Krebsforschung, Bd. x, Hft. 2, 1911.
- Schwartz: Osteosarcome des membres. Th. d'Agr., Paris, 1880.
- Segond: Transactions, Congress of French Surgeons, Oct., 1907.
- Stern: Ueber die traumatische Entstehung der inneren Krankheiten. léna, 1900.
- Thiem: Handbuch der Unfallkrankungen. Stuttgart, 1898.
- Thoinot: Les accidents du travail et les affections medicales d'origine traumatique. Paris, 1904 (Octave Doin, editeur).
- Thomas: Le cancer. Th. Doct., Paris, 1905 (Revue générale tres complete).
- Vibert: Medecine legale. 7 edition, Paris, 1907, p. 340.
- Vibert: Les accidents du travail. Etude clinique et medicolegale des affections internes produites par ces accidents, Paris, 1906.
- Werner Rave: Developpement des melanosarcomes sur les nævi, apres le traumatisme. Dissertation de Kiel, 1899. (Sur les 55 observations relevees par l'auteur, 19 portent la mention d'un traumatisme anterieur.)
- Wild: Ein Beitrag zur Statistik der Sarcome. I. D. München, 1891.
- Wurz: Beitrage zur klin. Chir., 1907, vol. xxvi, p. 567.
- Ziegler: Ueber die Beziehungen der Traumen zu den malignen Geschwülsten, Münchn. med. Wochen., 1895, p. 621.

ACUTE ULCER PERITONITIS IN TYPHOID FEVER.*

A PLEA FOR ITS EARLIER RECOGNITION

BY FORBES HAWKES, M.D.,

OF NEW YORK,

Associate Surgeon to the Presbyterian Hospital.

It is well established that patients suffering from so-called "intestinal perforation" in typhoid fever should be treated surgically. A surgeon's percentage of recoveries following operation for this condition will depend to a very great extent upon the number of hours that have elapsed between the time of the peritoneal invasion by the ulcer and the time when the patient is placed upon the operating table. This period will have to be shortened if the mortality records of this complication are to be improved.

It seems wise to put to ourselves frankly the question, Can we diagnose typhoid ulcer peritonitis at an earlier stage than is now the rule? If we feel that this cannot be done with the present means at our disposal, further attempts to shorten this period will have to be along executive rather than diagnostic lines. The writer believes, however, that in a great many cases an earlier diagnosis can and should be made, and that better methods should be adopted in order to give to the patient the full benefit of such an earlier diagnosis.

The general use of the word "perforation" in this connection has been extremely unfortunate, for it has unquestionably led the physician to disregard the changes which have preceded this event in his typhoid patients. Fixing his attention rather on the symptoms which may accompany or follow such an occurrence, which after all is often only

* Read before the New York Surgical Society, February 8, 1911.

like abdomen." There the rigidity present is grossly evident to any examiner the minute he puts his hand on the abdomen. It is the light shades of abdominal rigidity—those that appear at the inception of the peritoneal process—that we should be able to detect, and in order that their presence may not be overlooked the following precautions and methods should be remembered and observed:

Position of the Patient, His Surroundings, etc.—The patient should be lying out horizontally, with both knees drawn up. The position should be a comfortable one. The mouth should be slightly open, and the patient is told to breathe quietly. The arms should be at the side and extended; the head should be kept directly in the middle line and in a comfortable angle of flexion. The room in which the patient is examined should be warm, for a cool room may cause slight tremors in the abdominal muscles, which will prevent a satisfactory examination. The bladder should be empty.

The Examiner.—The examiner, whose hands have been warmed if necessary, stands on one side of the patient and first very quietly and very gently palpates with the flat of the hand those portions of the abdomen in which the patient does not complain of pain, tenderness, or discomfort, then gradually passes over to the affected parts. This gentle preliminary procedure affords to the examiner a rough idea of the general condition of the abdominal contents as to tumors, swellings, amount of adipose, points of tenderness, etc., and serves to allay a possible apprehension on the part of the patient. The next step is to determine the presence of rigidity in any of the abdominal muscles. This, in the writer's opinion, is best done with the most sensitive organs at our disposal—the finger-tips of the right hand. If the examiner is left handed, those of the left hand should of course be used. The wrist and the finger-joints are all kept slightly flexed, and a succession of short but very delicate "pushes" is made with them over the muscle that is being tested. It requires hundreds of examinations, as a rule, for the beginner to acquire the ability to detect slight differences

in the amount of rigidity present in different muscles or in the various portions of the same muscle; but the acquisition of this power is well worth infinite pains and patience on his part. The two sets of muscles which should be tested with special care for rigidity in typhoid patients are the recti and the lateral abdominal muscles. Owing to the usual preponderance of the dangerous ulcers in those coils of small intestine that are commonly found in the right iliac fossa and right paraumbilical regions, the right rectus and right lateral muscles should receive first attention. Taking into account the normal differences in muscle tone between the three segments of the rectus muscle, a preponderance of rigidity in any one of the three sections of the right rectus over that found in the corresponding section of the left is first to be noted. Then a rigidity of the right lateral muscle layer is sought for as compared with the same layer on the left side.

Abdominal Tenderness.—Abdominal tenderness has been mentioned as one of the signs of beginning ulcer peritonitis. It is usually present at an early period, and is localized to the area where the rigidity is found; it may not be marked at first in the cases where a fluid exudate separates the peritoneal surfaces in the vicinity of the progressing ulcer, but even here its appearance is seldom delayed. We cannot, of course, expect to elicit this sign very clearly in the toxæmic and comatose cases. In testing for the presence of tenderness, light pressure only should be used, otherwise adhesions may be broken up and pus and fecal material forced through the base of the ulcer.

Pain.—As a rule pain does not precede but *follows a peritonitis*. Cases operated on shortly after the appearance of pain often reveal an acute peritonitis that has undoubtedly been under way for some time before the pain began; this fact has unquestionably been the cause of delay in diagnosing a beginning peritonitis. Writers on the subject of so-called “perforation” mention pain as the prominent symptom, and most of them seem to think that a preperforative stage can-

not be diagnosed because there may be no pain at such a time. It is the writer's opinion that a recognizable amount of muscular rigidity and tenderness is often present at an earlier period than pain in ulcer peritonitis, and it is this very period of earliest peritonitis that must be recognized, if the post-operative mortality records in this condition are to be improved.

Dulness in the right flank, which shifts on turning the patient on the left side, may be an early sign of such a peritonitis; the fluid being formed first in the right iliac fossa region, then gravitating towards the pelvis, and later spreading to the abdomen generally. This shifting dulness is a very valuable sign if present at an early period. A *rising blood-pressure* and a *rising leucocytosis* may be of help in a doubtful case. Both may be absent, however, in the early stage of a peritonitis.

DIFFERENTIAL DIAGNOSIS.

Should rigidity of the paraumbilical part of the right rectus muscle be found, or of the lateral muscles just external to it, especially if it be associated with a tenderness which has not previously been present, a diagnosis of beginning peritonitis in the right iliac fossa is assumed.

A differential diagnosis is then to be considered between "*beginning typhoid ulcer peritonitis*" and "*beginning appendix peritonitis*." Unless the patient's appendix has been removed this is sometimes difficult. Fortunately, however, such differential diagnosis is not usually of vital importance, because a typhoid appendicitis which has progressed to the extent that it is associated with peritonitis (peri-appendicitis) should instantly be followed by the removal of the appendix. Should there be doubt it is safer to act as though the condition were one of ulcer peritonitis.

The differential diagnosis between an acute ulcer peritonitis and a sudden and copious *intra-intestinal hemorrhage* in typhoid fever is usually an easy one. In intra-intestinal hemorrhage without an accompanying acute peritonitis, there

is no muscular rigidity. The patient may complain of pain, but often there is none at first. If the hemorrhage is at all extensive, there is apt to be a sudden drop in the temperature, with a marked elevation of the pulse-rate, and the patient's color becomes distinctly paler. It is very rare to have both acute peritonitis and hemorrhage occurring simultaneously, but a peritonitis will frequently occur a few days after a hemorrhage, from further progress of the ulcer. In the earliest stages of an acute ulcer peritonitis little or no change can be noted in the previous pulse-rate or in the temperature or respiration, but there is always some discoverable muscular rigidity, and usually some tenderness. If the patient is so comatose from a co-existent typhoid sepsis as to be unresponsive to the palpation of the abdomen, it will be difficult to judge the degree of tenderness present.

It is the writer's opinion that in a great many of the cases of intestinal hemorrhage in typhoid fever there co-exists a certain amount of low-grade peritonitis, which may at any time suddenly take on the characteristics of an acute process when the ulcer from which the hemorrhage has occurred has increased in depth or in extent. A recognizable amount of muscular rigidity should be present when this event has taken place.

When, during typhoid fever, there occurs an *acute cholecystitis* which progresses until there is an affection of the peritoneal covering of the gall-bladder, rigidity of the overlying right rectus muscle in its upper third will be present, with tenderness over the gall-bladder region. If it is a primary attack and the stomach, transverse colon, or omentum has not as yet become agglutinated by peritoneal adhesions to the gall-bladder, there may be no mass to be felt. As the peritonitis extends, rigidity of the lateral abdominal muscles in the right ilio-costal space will be easily recognizable. A peritonitis from a typhoid ulcer located either in the hepatic flexure or in the upper part of the ascending colon should, however, be kept in mind where rigidity in the right upper quadrant is encountered.

A *right lower lobe pneumonia* or a *right-sided pleurisy* will often be associated with rigidity of the upper part of the right rectus and of the right lateral (iliocostal) muscles. Careful thoracic auscultation should determine such a diagnosis. Diminished breathing may be the only sign at first.

An *extensive infarct or inflammation of the spleen* will be accompanied by rigidity of the left upper rectus and lateral iliocostal muscles and by local tenderness, imitating the *kidney infarcts and perinephritis* in this particular. So will peritonitis about a typhoid ulcer in the splenic flexure of the colon. If there is no blood or pus in the urine a positive differential diagnosis may not be easy.

A typhoid patient who has *fallen out of bed* may suffer a contusion of the abdominal muscles. In such a case co-existing contusions of the skin or subcutaneous ecchymoses over prominent bony points are likely to be present. If found they should make us suspicious of an occurrence of this kind.

A *hemorrhage into one of the abdominal muscles* may occur, associated with a degeneration of the muscular fibres (Zenker's degeneration). The localized hemorrhage usually presents a raised or softened area in the muscle, differing in this way from a condition of muscular rigidity.

Tenderness in the suprapubic region should direct our attention to the possibility of a *distended bladder*. If unable to pass a sufficient amount of urine, the patient should be catheterized. Muscular rigidity present after this in the lower segments of the recti should make us suspicious of a peritonitis, either from an ulcer situated in a pelvic loop of intestine (small or sigmoid) or from a pelvic appendix. In women a vaginal examination should be made to clear up possible uterine or adnexal disease. A rectal examination here may be of distinct help.

A *soft tympanites* occurring during typhoid fever should be carefully watched. If it becomes a *hard tympanites* the muscular rigidity then present will indicate that there co-exists a certain amount of scattered peritonitis, probably

from multiple ulcers. The writer has seen this condition in several toxic cases where the toxæmia had so overwhelmed the patient that the existence of pain and the presence of tenderness could not be ascertained; operation had therefore not been suggested. The autopsy showed areas of peritonitis mostly in the right side of the abdomen, apparently from the ulcers. A *periostitis of one of the ribs* that form the lower costal border may be associated with some rigidity of the abdominal muscles attached to that rib. Here localized tenderness at first over the affected rib should make the diagnosis clear if later there should be swelling.

An acute attack of *renal or ureteral colic* may come on during the progress of a typhoid fever. The great rarity of this complication is probably due to the fact that the typhoid patient is usually quiet in bed and that existing calculi are therefore subjected to little or no jarring. During the acute period of the attack there is usually some rigidity of all of the muscles on the right side. The history of a previous attack and the presence of blood in the urine would be of help. A radiograph might confirm such a diagnosis.

A *peritonitis from a mesenteric gland* that is on the point of suppuration cannot usually be distinguished from a beginning ulcer peritonitis, for they may both be present in the same case from the same infection.

From the foregoing it will be seen how important becomes the determination of even the lightest form of muscular rigidity, and how valuable to the patient may be the examiner's ability to accurately locate such rigidity in one of the quadrants of the abdomen. Such a beginning peritonitis may not last as a moderate process for more than a few hours; its duration as such may even be shorter than this, hence abdominal examinations of all typhoid patients between the third and sixth week of their disease should be made by a *competent trained diagnostician* at intervals of a few hours if the existence of such a beginning peritonitis is to be discovered.

This may seem not to be a feasible procedure. Before

discussing its feasibility let us consider the conditions which usually surround typhoid patients at the present time in what is often regarded as an almost ideal place for them, namely the "typhoid ward" of any of the larger city hospitals. They are there under the supervision of an eminent attending physician with a picked staff of medical internes and a corps of energetic and experienced nurses.

During the hours from 8 A.M. to 8 P.M., such a ward will be visited once, possibly twice, by the attending physician, who will devote considerable time to the typhoid patients. At other times during these twelve hours there will probably be some one member of the interne staff coming and going in the ward a good part of the time, so that any change which he or a nurse may notice in the condition of any one of the typhoid patients will be immediately reported to the house physician, or to the next member of the interne staff if the house physician is otherwise occupied. The patient is then carefully examined.

If there has been a complaint of abdominal pain and the examination reveals a change in the patient's appearance, with marked muscular rigidity and tenderness, the house physician, suspecting so-called "perforation," is apt to seek a confirmation from his attending physician. If by good fortune he can be located and can leave his work and hurry to the hospital, the delay will probably not be a long one. If the diagnosis be confirmed and the same good fortune attend the location of one of the attending surgeons, the total delay may not amount to more than a few hours. There is apt to be greater delay than this, however, and it is a fact that operations on so-called "perforating cases" are seldom done in so short a time. Especially is this the case when the peritonitis has started at night.

At night the nursing staff is reduced and even if special nurses are in constant attendance on the typhoids a slight change in a patient's condition associated with a light degree of abdominal discomfort or pain is not so readily noticed as in the daytime. This is apt to cause a delay in securing

a visit of the medical interne on night duty. This is especially true between the hours of 12 M. and 7 A.M. By the time the attending physician has seen the patient and the surgeon has confirmed the latter's diagnosis and the patient is placed on the operating table, several valuable hours have probably been consumed. If we add to this the time that has elapsed between the beginning of the peritonitis and the first distinct complaint of abdominal pain on the part of the patient we shall often have a delay of at least six to eight hours before operative measures are instituted, and when the peritoneum is opened it is usually found full of pus.

What is the remedy for all this? First, a skilled *resident* (salaried?) *physician* with previous ample experience in a large general hospital; second, a skilled *resident* (salaried?) *surgeon* of equal surgical experience who can reach the bedside day or night in a few minutes; third, "a special night typhoid service," consisting of rounds made to all waking typhoid patients (both ward and private) every two hours, from 8 P.M. to 8 A.M. by those members of the interne staff who have had previous experience in diagnosing acute surgical abdominal diseases and who will therefore be on the lookout for the earliest evidences of muscular rigidity. In this way any waking typhoid who *on inquiry* complains of the least degree of discomfort in the abdomen may be carefully examined. If muscular rigidity or tenderness be present, the resident physician can immediately be notified and within a few minutes the resident house surgeon may also be at the bedside; if the condition be judged one of beginning acute ulcer peritonitis, another twenty minutes should be sufficient to have the operating room ready. In this way the operation may be undertaken by the resident surgeon within one or two hours from the time when the peritonitis has started. Consent to operation should be obtained and recorded on admission in every case where symptoms are present suggestive of typhoid fever. Delay is thus avoided at a time when every minute counts.

In outside practice what can be done along these lines?

It seems to the writer that in the case of well-to-do patients the practitioner will wisely secure the bedside attention of two recent hospital graduates, one for day duty (12 hours) and the other for night duty (12 hours), from the beginning of the third week of the disease. Under these circumstances the graduate who keeps constantly in mind the first signs of an ulcer peritonitis can, at the very first complaint on the part of the patient of any abdominal discomfort, examine the abdomen and if muscular rigidity be present summon the practitioner to confirm the diagnosis. The practitioner will have previously made out a list of the surgeons (probably three at least) who upon inquiry have expressed to him the likelihood that they will be available during these three or four weeks and within reach by telephone. He will then immediately call on one of these surgeons to confirm his diagnosis and to operate within the hour if such is the decision. In any of the larger cities this forestalling should be possible with such surroundings, and it seems probable that in this way an operation could usually be started within two hours of the first signs of peritonitis. In non-toxæmic cases the chances of such patients to recover from this complication should be at least 50 per cent.

In outside practice where few patients can afford such skilled attention, and especially in the country districts, it is doubtful whether the present mortality percentage in typhoid ulcer peritonitis can be much reduced, unless the nurse in charge be able to detect the early stages of abdominal rigidity. Without going into the general theme of instruction to nurses, the writer feels that they should have special instruction in this subject. Such a practical course could be included in the one on surgical emergencies. While their training does not aim to qualify them to make accurate differential diagnoses in acute abdominal diseases, still it is fair to presume that after such practical instruction they should be able to ascertain the presence of muscular rigidity and its location. The importance of this subject is so great that superintendents of training schools may well give it their earnest consideration.

It may, of course, occasionally happen that the practitioner will be making his daily visit during or a short time after the first appearance of such peritoneal change, and that a surgeon can reach the case soon afterwards, but this must inevitably be the exception. One would say, therefore, that the ideal place at the present time for a typhoid patient would be in the general or private wards of a large medical and surgical hospital, where such skilled attention as the writer has previously mentioned can be secured.

It has been estimated that so-called "typhoid perforation" has been the cause of 25,000 deaths annually in the United States.

OPERATIVE CONSIDERATIONS.

Given the presence of a light degree of muscular rigidity and tenderness in the right iliac fossa or right paraumbilical region, are we justified in advising operation?

The writer believes that operation is here indicated for the following reasons: In most of the cases a beginning ulcer peritonitis will be found. If the more common variety, the fluid exudative type, be found, this can by properly placed drainage be either arrested or converted into the dry type. The relief of tension will favorably influence the inflammatory process about the ulcer or ulcers, stopping it entirely where it is of mild type (Case IX), or preventing the development of pus in the moderately severe cases (Case VIII) or helping to localize it in the more severe ones (Case VII), so that in the latter it will either discharge itself later through the drainage tract or be accessible for subsequent evacuation.

If the necrotic process be found to have already invaded the peritoneal layer over the ulcer, a covering over of this area by suture, with or without omental grafting as the case may be, will be in order; or simple drainage may be used.

Washing out the peritoneal cavity in this early period does not seem to be advisable. In those very rapidly progressing cases, however, which are fortunately of unusual occurrence, where the bowel contents have escaped at an early period

into the general peritoneal cavity from the giving way of the necrotic base of the ulcer, their removal by flushing is indicated. Here pelvic drainage also will usually be provided. If on opening the abdomen an acute appendicitis be found, an appendectomy should immediately be done, but here also search should be made for ulcer peritonitis, for an associated secondary peri-appendicitis of a marked type, from extension, may well exist alongside of an ulcer peritonitis. Local or general anæsthesia will be used according to the operator's judgment. The assumption of Fowler's position after operation seems of distinct help. It is a noteworthy fact that a very large number of the non-toxic cases who have been subjected to an early exploratory operation for a "suspected perforation," and in whom peritonitis has been found but no perforation, have recovered. The writer's belief is that in many of these, even where no drainage was used, the opening of the peritoneal cavity with the necessary handling of the intestines either arrested the peritonitis or changed its type so that the local conditions about the ulcers were favorably influenced and perforation averted. In cases where there has been an intestinal hemorrhage the probability of a supervening peritonitis should constantly be kept in mind. Examinations in these cases should be made certainly as often as every two hours if the patients are awake, in order to discover the earliest appearance of muscular rigidity in the right iliac fossa. Should it appear, the advisability of doing an exploratory operation for the peritonitis should be very seriously considered. The writer is willing to go a little further and the suggestion is here made that such exploratory laparotomy may not only influence the peritonitis in a favorable manner, but by so doing secondarily hinder the further destruction of the blood-vessels in the ulcer base, and avert hemorrhage. While a recommendation of this kind would not seem to be justified unless there exists a very distinct amount of rigidity in the right iliac fossa, the presence of the latter would make the procedure seem eminently proper.

It is worthy of note that the cases who have had in-

testinal hemorrhages followed by ulcer peritonitis with or without perforation, and who have been operated upon and recovered, have rarely had any subsequent hemorrhages.

CASE IX.—S. D., colored, aged twenty, was admitted to the Presbyterian Hospital on Nov. 25, 1906, in about her fourth week of typhoid. She was apathetic and at times comatose. General tremor was marked, so much so that the taking of the pulse at the wrist was almost impossible—a markedly toxæmic case. About 12 M., November 28, 1906, her pulse which had been about 120 had become much more rapid. When the writer was called to see her about ten hours later he found that the heart-beats were 160 to the minute, that her abdomen was markedly rigid over the right iliac fossa, and that there was moderate rigidity in the right flank. There was slight dullness in both flanks. On account of her apathetic condition it was hard to judge the amount of tenderness that was present. A diagnosis was made of ulcer peritonitis and consent for operation then obtained from her husband. Operation was done on Nov. 29, 1906, at 12.30 P.M. On account of a suspicion of pneumonia cocaine was used. The mixed form of peritonitis was found, the peritoneum being œdematous in places with the fluid exudate, in places dry with an adhesive peritonitis; the appendix was normal except for its peritoneum. About one-half inch from the ileocæcal valve in the small intestine there was an indurated patch representing the site of an ulcer which had not gone on to perforation. The vessels over this patch and for some distance from it were tortuous, congested, and of a bright crimson color. Three similar areas were found further up in the small intestine, and about four inches apart. There were some large and inflamed mesenteric glands. The pelvic contents were normal. A gauze and rubber tissue cigarette drain was placed to the site of the ulcers. The operation was followed by distinct improvement in the quality of the pulse and in the patient's general condition. The abdominal rigidity entirely disappeared. Her toxæmia became still more marked, however, and about the third day after her operation the signs of a double pneumonia were distinct. She died. The autopsy showed that there was no perforation and that the peritonitis had subsided. There were only a few fine adhesions alongside of the drain.

In this case proper drainage was followed by the entire subsidence of the peritonitis. Had there not been so much toxæmia it is fair to presume that this patient would have recovered.

CASE VIII.—G. B., chauffeur, aged thirty-nine, was admitted to the Presbyterian Hospital, on Oct. 29, 1906. On Nov. 8 and 9, the patient being in about the third week of his typhoid, several hemorrhages had occurred. Thirteen ounces of blood were passed. About eight o'clock the next morning, he complained of some discomfort, followed by pain, in the epigastrium. This shifted in the course of the hour to the right iliac fossa. He was seen by the writer about an hour later, when distinct abdominal rigidity was found all over the right side; there was also some rigidity on the left side. The paraumbilical portion of the right rectus exhibited the greatest rigidity. Tenderness in the right iliac fossa was just appreciable to the lightest form of pressure. There was shifting dullness in both flanks. The pulse was about 120 (there had been little change in it). A diagnosis was made of pre-perforative ulcer peritonitis and immediate operation advised. Laparotomy was done about one and one-half hours after the beginning of the abdominal pain. The abdominal cavity contained more than a pint of clear serum, most of it in the right iliac fossa. In the small intestine, about six inches from the ileocæcal valve, there was a thickened area, with crimson peritoneal surface, the site of an ulcer. The loops of intestine in the right iliac fossa were all congested, but no perforation was found; the appendix was normal. The mesenteric glands were enlarged and congested. A gauze and rubber tissue cigarette drain was placed to the ulcer site. The patient made an uneventful recovery.

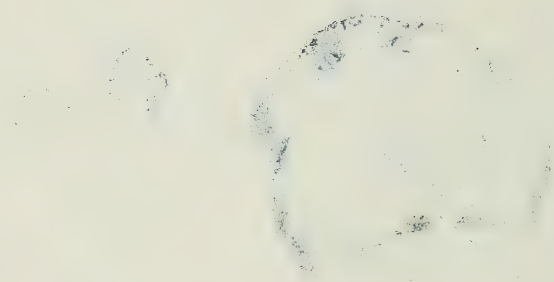
This patient had more than a pint of free serum in his abdominal cavity from ulcer peritonitis about one and one-half hours after his first complaint of abdominal discomfort, and he had very marked abdominal rigidity by the time this discomfort had become actual pain. Appreciable rigidity had undoubtedly been present before this. Here also proper drainage was sufficient to effect a cure.

FIG. 1.



Peritonitis from perforated typhoid ulcer, in a "relapse" case. Period elapsing between development of symptoms and operation, about six hours. Loop of small intestine about one foot from ileocaecal valve, showing situation of ulcers; perforation of one; general congestion, firmness, dilatation of intestinal walls, and swelling of mesenteric glands. (Case VII.)

1871



Sketch of the landscape from the summit of the mountain.

CASE VII.—E. G., aged thirteen, school girl, came to the Presbyterian Hospital suffering from a relapsing typhoid on January 5, 1906. For the following nine days she had run a fairly typical typhoid course. There had been some abdominal distention, but no rigidity had been noted. She had taken her baths and nourishment well. There had been a positive Widal reaction on January 11. On January 14, about 4 A.M. (the abdominal distention having become more marked during the night), she had had a severe chill and her temperature had risen to 104.6° F., her pulse-rate to 132, and she had complained of pain in the lower abdomen. This localized itself shortly in the right iliac fossa. The writer was called to see her about 9 A.M. (five hours after her chill). Her abdomen at that time was markedly rigid over all, the right rectus distinctly more so than the left. There was a free fluid wave across the abdomen. Extreme tenderness was present with marked distention. There was very little respiratory movement in the abdomen. A diagnosis was made of spreading peritonitis, probably from a perforating typhoid ulcer. Operation was undertaken in a few minutes. Free seropurulent fluid in large quantities was found in the general peritoneal cavity, with scattered particles of lymph. On one of the intestinal loops there were several patches which looked as if they were about to break down, and one patch which was perforating in the centre; from this faeces exuded when the loop was handled. A purse-string suture of silk was placed around this patch and over it a continuous Lembert. A high pillow was placed under the shoulders to allow the free fluid to gravitate into the pelvis, and a flushing of the pelvis was then carried out with hot salt solution. A long gauze and rubber tissue cigarette drain was placed to the bottom of the pelvis. Fowler's position was used for several days. The patient went on to complete recovery, the resulting fecal fistula closing in a few weeks.

In this case the findings at operation justified the conclusion that some peritonitis had existed for several hours before the acute attack began. The chill and marked rise of temperature and of pulse-rate, with the pain in the lower abdomen, undoubtedly represented the change from a serous to a purulent exudate. The writer feels that this occurrence

might have been avoided by a prompt laparotomy done at the earliest appearance of abdominal rigidity.

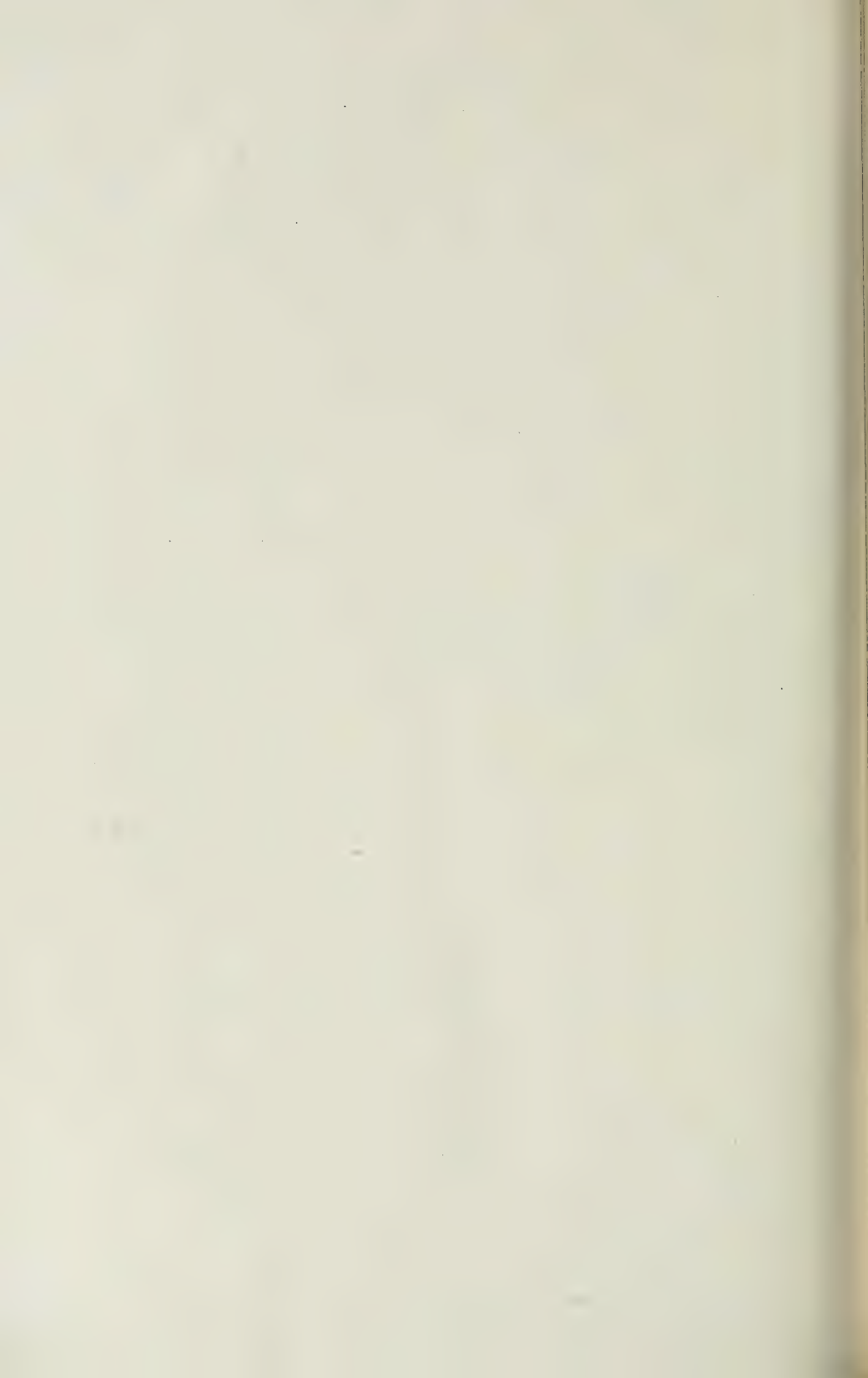
CASE XI.—S. S., aged twenty-one, clerk? was admitted to the Presbyterian Hospital on Aug. 31, 1909, apparently in the end of his second week of typhoid. On Sept. 9, about 10 A.M., he complained of pain across his abdomen, and his appearance became somewhat changed. His temperature rose to 105° F. and his pulse-rate to 108. He vomited several times. A little after 4 P.M. he was seen by a surgeon who was reported to have been unable to detect any abdominal rigidity and on this account had advised against operation. The writer saw him within three-quarters of an hour from this time and found very marked muscular rigidity over the whole abdomen, with shifting dullness in the flanks and general tenderness. A diagnosis was made of an extensive peritonitis, probably from typhoid ulcers. The patient was operated upon about twenty minutes later. Free gas was found in the right iliac fossa, and the peritoneal cavity generally was filled with greenish-yellow ropy pus. On a loop of small intestine, about six inches from the ileocæcal valve, was found an indurated area, of about the size of a twenty-five cent piece, with a small perforation in its centre. The peritoneal surface of this area was greenish yellow in color, and on a neighboring coil of small intestine was seen a peritoneal plaque of the same size and color, representing apparently the part where this adjacent coil had been in contact with the ulcer area. Several Lembert sutures were applied, folding in the ulcer area. Drains were placed as follows: one of plain gauze to the right iliac fossa close to, but not touching, the line of Lembert sutures; two others to the bottom of the pelvis (one being a gauze and rubber tissue cigarette drain, the other a split rubber drainage tube which contained gauze). The patient had been placed with the shoulders elevated as soon as the peritoneal cavity was opened. After the operation Fowler's position was continued for several days. A small fecal fistula formed which soon closed. A slow but satisfactory recovery followed.

In this case operation was done about seven and one-half hours after the beginning of the acute symptoms. The writer is convinced that an appreciable amount of abdominal

FIG. 2.



Peritonitis from typhoid ulcer; end of third week of typhoid. Period elapsing between development of symptoms and operation, 1 hour, 30 minutes. Loop of small intestine about six inches from ileocaecal valve, showing site of underlying ulcer; general congestion, firmness, dilatation of intestinal walls, and swelling of mesenteric glands. (Case VIII.)



rigidity was present at the time of the acute onset, and probably for an hour or so before this. By an earlier operation the suppurative process might have been averted.

The following seven additional cases are here reported, making with the previous four a total of eleven operated upon by the writer for acute ulcer peritonitis in typhoid fever. Of these eleven, three recovered and eight died, a mortality per cent. of 73. If the three toxæmic cases (Cases II, IX, and X) are excluded from this list, it will then show eight cases with five deaths, a mortality percentage of 62.5. While almost all of the markedly toxæmic cases die of their toxæmia, whether operation be done or not, it does not seem fair to withhold operation from such of them as exhibit the slightest signs of ulcer peritonitis; for they may thus be helped to overcome this extra tax upon their resistance. Local anæsthesia would seem best for the operation in these cases, and the shock of simply opening the abdomen and inserting a proper drain to the right iliac fossa should be slight.

CASE I.—C. H., clerk, aged twenty-four, was admitted to the Presbyterian Hospital on Oct. 5, 1900, with a diagnosis of typhoid fever. He ran an average typhoid course during the following five days. The writer was called to see this patient about 10 P.M., Oct. 11. He had then been suffering from abdominal symptoms for over twenty-four hours. They had consisted of continuous abdominal pain, hiccupping, and distention. At 11 P.M., Oct. 11, his condition was as follows: He had marked abdominal rigidity, some distention, and his pulse was of poor quality. His general appearance was bad. A diagnosis was made of intestinal perforation with general septic peritonitis, and operation immediately undertaken. It revealed a general peritonitis with much purulent fluid and fibrinous flakes. There was free fecal material in the peritoneal cavity. About one foot from the ileocaecal valve was a perforation of the size of an ordinary lead-pencil, through which fæces were issuing. The ragged edges were trimmed hastily with scissors and two layers of Lembert sutures applied. There were a number of other ulcer patches which had not perforated. The peritoneal cavity was irrigated with several gallons of normal salt solution,

and drains placed to the pelvis. In spite of acute stimulation the patient died about five hours after the operation.

CASE II.—G. McL., aged thirty-one, was admitted to the Presbyterian Hospital, on Aug. 15, 1903, with a ten-days history of malaise and of slight abdominal pain, chiefly in the right iliac fossa. He went through a fairly typical typhoid attack, and his temperature became normal on Sept. 6; he then had a relapse and in a few days became actively delirious and distinctly toxæmic. On Sept. 20, early in the morning he had a chill and his temperature rose to 106° F. His leucocytes were 4200. At 4 P.M. his abdomen had become very tense, and peritoneal friction râles were heard over its upper part. At 5 P.M. his leucocytes were 3500. At 8 P.M. his leucocytes were 3900 and the abdominal condition had become still more marked. At midnight his condition had become desperate. The writer was called in to see him at this time and found his abdomen markedly rigid over all, distended, and the signs of free fluid and gas. Diagnosis was made of a general septic peritonitis from perforated typhoid ulcer. Operation at midnight, Sept. 20, about eighteen hours from the beginning of his symptoms. The general peritoneal cavity was full of pus and purulent serum. There were no adhesions. About twelve inches from the ileo-cæcal valve there was a perforation in the small intestine, from which grayish fecal matter was issuing. There were several other patches about to break down. Lambert sutures were placed on all these and the peritoneal cavity irrigated with salt solution. Drainage was used. Intravenous infusion was done during the operation on account of the patient's desperate condition. He died the next day.

CASE III.—W. K., aged twenty-one, designer, was admitted to the Presbyterian Hospital, on Sept. 17, 1904, with a history of fever and headache for about a week. He ran a typhoid course, responding well to his treatment. About 1 P.M., Sept. 22, he complained of severe abdominal pain, and his abdomen became very rigid, especially in the lower part. Later the rigidity and tenderness became still more marked, and he passed into a state of general collapse. The writer was called to see him about 6 P.M. His condition at that time was as follows: there was general abdominal rigidity, very marked tenderness over all, and a pulse of poor quality. His appearance was

alarming. A diagnosis was made of general peritonitis from perforated typhoid ulcer. At the operation which was done about five and three-quarter hours after his attack of severe pain, a general peritonitis was found with much turbid fluid and pus; there was a perforation in the small intestine about eighteen inches from the ileocaecal valve; there was some fibrinous exudate about the ulcer area. Two layers of Lembert sutures were placed, and the general peritoneal cavity was flushed with hot saline. Cigarette drainage was used. During the operation an intravenous infusion had to be resorted to. Active stimulation was continued and he rallied from the operation, but died in about six hours.

CASE IV.—M. M., aged nineteen, was admitted to the Presbyterian Hospital on Sept. 27, 1904, with a fairly typical typhoid history. He had in addition complained of some pain in the centre of his abdomen. On Sept. 29, at 9 P.M., he complained of pain in the right iliac fossa and there was tenderness there. At 11 P.M. his pain had increased. In the records there is a statement that there was slight rigidity at that time. At 12.10 A.M. there was sudden severe pain in the right iliac fossa and general tenderness and rigidity, with slight distention. Operation was decided upon, but was not obtained until about 4 A.M. Operation was done seven and a half hours after the onset. Free brownish fluid with fecal odor was found in the cavity. There was also some inflammation about the ileocaecal valve there was a perforation about three-eighths of an inch in diameter. The cavity was irrigated with normal salt solution. Sutures were inserted. On account of the patient received an intravenous infusion. Following the operation the peritonitis did not subside and he died after the operation.

CASE V.—S. R., aged 25, with a typhoid history was negative except for a fever done several years before. She died Oct. 5, 1905. She had then been ill forty-seven days with high temperature. Two weeks previously she had

the pulse was increased in frequency and in which there was abdominal pain followed by distention; since then she had had a number of these attacks which lasted about six hours. Perforation had been considered, but her attending physician thought that the indications were not sufficiently plain for operation. About 8 P.M., Oct. 5, she had another attack decidedly more severe in character, and there developed general abdominal rigidity. The writer was sent for at 11 P.M. and reached her home in the country at 1 A.M. Her condition at that time was as follows: There was an anxious expression to the face, marked anæmia, and a pulse-rate of about 170, weak and irregular. The abdomen was distended. The right rectus muscle was rigid throughout, and there was extreme tenderness over the right iliac fossa. There was dulness in both flanks, and a suggestion of a fluid wave across the abdomen. Diagnosis was made of repeated perforations. Operation was done about 1.30 A.M. under cocaine anæsthesia. Scattered throughout the right side of the abdomen were a number of pockets containing pus which differed somewhat in color and consistency in the different pockets. In the region of the ileocæcal valve there was a large collection of pus; there was also much pus in the pelvis. It was hard to make out the distance of the various ulcers from the ileocæcal valve on account of the adhesions. Cigarette drains were inserted into the right iliac fossa. The patient's condition after the operation, but later in the day, became still more rapid and she

On the twenty, was admitted to the Presbyterian Hospital, New York, on September 25, 1905, in the middle of the disease. From the time of admission until the day of her death the course was irregular, due perhaps to the attacks that occurred. On Oct. 24, she was seized with a severe pain in the right iliac fossa, which lasted a few minutes; this recurred several times of a considerable amount of pain, associated with marked tenderness, but there had been little or no change in the respiratory rate. The leucocyte count was 12,000. The writer was called to see her on Oct. 25. She was then in a very poor con-

dition, with intense rigidity of all the abdominal muscles. There was some dulness in both flanks; his pulse was of poor quality, and he was somewhat cyanotic. Operation was done at 10.30 A.M., at least nine and a half hours after the beginning of his acute symptoms. The peritoneal cavity was found full of grayish fluid, and there was a general peritonitis. Six ulcers were found in the small intestine within three feet of the ileo-cæcal valve, all of them about to perforate except one which had already perforated and from which pus and gas escaped. Circular sutures were placed, re-enforced by Lembert sutures, and the peritoneum flushed with salt solution. A cigarette drain was placed to the pelvis. The patient died shortly after the operation.

CASE X.—A. H., aged thirty. This patient was in his fourth week of a severe typhoid. His pulse-rate had been about 120, and his temperature about 104° F. He had been distinctly toxæmic from the start. His bronchitis had been severe and there had been marked congestion at the bases of both lungs. There had been three intestinal hemorrhages, one of about fourteen ounces, the other two smaller. He had rallied fairly well from these. On April 16, about 9 A.M., he had a chill and went into collapse, the pulse being almost imperceptible and the temperature 106.2° F. Marked distention set in. The writer was called about 10 A.M., and reached the bedside about 11, prepared to operate. The patient's condition at that time was as follows: He was comatose (but could be slightly roused), and cyanotic. His pulse-rate was about 140. It was soft and weak. There was abdominal rigidity over all, the muscles on the right side being distinctly more rigid than those on the left. The whole right side was dull. There was evidently some tenderness in the right iliac fossa. Operation was done a few minutes later under eucaïne anæsthesia. A quart or more of turbid, foul-smelling fluid was found in the general cavity. About sixteen inches from the ileocæcal valve were two perforations, and adjoining these were several other circumscribed ulcer areas of dark color. Fecal matter was oozing through the perforations. There were many mesenteric glands in a condition of acute inflammation. The perforations were covered in by Lembert sutures and two cigarette drains were placed, one to the pelvis, the other to the right iliac fossa. The

patient stood his operation fairly well, but coma gradually deepened and he died about five o'clock the same afternoon.

A critical review of these cases brings out the fact that in the great majority of them a sufficient amount of importance had not been attached to the change in their abdominal condition. While a sudden attack of sharp pain, in the hospital cases, had invariably brought one of the members of the interne staff to the patient's bedside, the records show that a very careful search at that time for the slightest amount of muscular rigidity had not been carried out. This is perhaps too much to ask of them. The writer was once a member of this medical interne staff, and he now appreciates that at that time he was unquestionably unable in all cases to distinguish such differences. The importance of this subject was not sufficiently dwelt upon at that time in undergraduate instruction. The pathological conditions, however, which he then saw in the so-called "perforated" cases led him to the conclusion that it would be of the greatest value to the patient if the peritoneal changes, which had evidently been progressing in almost all cases for many hours before any acute symptoms had appeared, could be detected very shortly after their onset. By broad analogy with the affections of the appendix it seemed probable that a beginning peritonitis in typhoid fever could often be arrested by early operation if the diagnosis could be made with a reasonable amount of certainty.

In considering the various signs of beginning peritonitis, none seemed constant except that of muscular rigidity. The ability, therefore, to detect its presence at its very beginning seemed most important for the surgical diagnostician. Since that time the constantly increasing number of patients brought to the hospital suffering from acute abdominal conditions associated with varying degrees of peritonitis has afforded to the writer such experience as he then desired, and in his bedside instruction to the students he has constantly endeavored to impress upon them the paramount necessity of

familiarizing themselves at every opportunity with the various degrees of rigidity present in the different segments of the abdominal muscles in cases of peritonitis and of comparing these with the conditions found at operation.

CONCLUSIONS.

If the distinctly toxæmic cases are excluded, an "early operation" for the others should give excellent results. This "early operation" should be one undertaken very soon after the appearance of the lightest recognizable shade of abdominal muscular rigidity.

The writer believes that this "early operation" is not usually suggested because the diagnostic value of abdominal rigidity at its first appearance is not appreciated, and that on this account a persistent search for it is not made from the time that the patient begins to suffer from abdominal discomfort. The records show that it is only recognized as a rule when marked pain is complained of, and unless other alarming symptoms are present that the case is unfortunately too often "watched" until the rigidity becomes general and a spreading peritonitis has become well established.

Enough evidence is at hand to justify the statement that an early exploratory operation exerts a distinctly beneficial influence, not only on the ulcers that may be about to break down but on others as well, thus preventing their further progress towards separate perforations, a condition recognized as almost invariably fatal (see Case V). Whatever may be the opinion held in regard to the advisability of peritoneal drainage for pus conditions originating in the female pelvis, or in cases of suppurative appendicitis, it seems that the co-existing typhoid poisoning should induce us here to follow that procedure which we believe will diminish peritoneal congestion, and by transforming the fluid variety of peritonitis about the ulcers into the adhesive one, bring about a protecting condition in their vicinity.

THE RADICAL CURE OF FEMORAL HERNIA IN THE AGED.

BY PAUL M. PILCHER, M.D.,

OF BROOKLYN, N. Y.

IN children, a femoral hernia is usually congenital; in adults, it is most frequently the result of sudden muscular effort, and may be termed an acute hernia. In the aged, it is commonly a hernia of slow development due to a gradual relaxation of the structures forming the femoral canal. In children and adults, the operation essential for the relief of this condition is necessarily more extensive, and may be undertaken without regard to the period of time consumed in carrying out the various steps of the operation, and without the other dangers which are present in all operations upon the aged. It has been observed that the simpler methods of closing the femoral canal which are usually sufficient to bring about a cure in the aged, are not so universally successful in younger subjects, and it is on this account that so many operations (numbering in the neighborhood of 75) have been devised for the relief of femoral hernia.

In the majority of cases of femoral hernia in the aged, the condition passes unnoticed until some accident occurs, which gives rise to pain or intestinal obstruction. Many times there is present an inguinal hernia on the same side, or a double inguinal hernia, a truss being used for the control of these but nothing done to hold in restraint the femoral defect.

As has already been stated no attention may be paid to the defect until some accident has occurred to the hernia, and in the majority of cases—60 to 70 per cent. at least—this accident consists of a strangulation of the intestine contained within the sac of the hernia. The problem presented to the surgeon is as follows:

He is called upon to treat a patient already infirm by reason of years; there has existed for some time an obstruction of the bowels; the patient during that time has been

unable to take food and is therefore weak from the want of it; he is also already suffering from the absorption of intestinal toxins which are the result of fermentation and putrefaction; the mind is somewhat obscured, and the complaints of the patient do not direct our attention to the site of the trouble; the cardiac function is impaired by reason of the patient's age and the autointoxication; the respiratory centres and lung tissue are in a condition favorable for the development of post-operative pneumonia and œdema of the lungs; the kidneys are congested and probably the seat of chronic degenerative changes; there is also complete reversion of all gastro-intestinal functions.

The usual history given by the patient is the following:

For the last five or six days there has been persistent nausea and vomiting, ascribed by the patient to an acute attack of indigestion; oftentimes the acute gastric symptoms subside, but there remains a continual nausea, the tongue is coated, there is loss of appetite, with attacks of vomiting once or twice a day, and enemata are administered without effect; the heart action at first is not especially rapid, and no concern is felt for the condition of the patient excepting that the bowels cannot be made to move, the patient cannot retain any nourishment, and there is a general lassitude and weakness unnatural to him. However, medical treatment does not improve the condition, and the vomiting gradually becomes fecal; finally the surgeon is called. His examination reveals a tumor characteristic of femoral hernia, tense, and not especially tender, a most striking symptom being the lack of pain in the region of the hernia. The diagnosis is easily made, and the question of operating upon the patient is considered.

If we give such a patient a general anæsthetic,—be it chloroform, ether, nitrous oxide, or ethyl chloride,—the primary result will be the same, that is, a depression of all the body functions; naturally, this is the effect least to be desired. The general anæsthetic weakens and increases the rapidity of the heart, irritates the lung tissue, irritates the kidneys, increases the tendency to vomiting, while the possibility of inspiratory pneumonia becomes very great on account of the fecal vomiting and the unconsciousness of the patient.

These dangers, however, can all be avoided by the use of local anæsthesia. Using a minimum amount of cocaine, it is no exaggeration to say that the operation can be performed without pain to the patient, his greatest shock being the thought of the operation, which may often be completed before he is aware of anything having been done. Instead of a weakening of the pulse, the heart usually becomes stronger and its action slower as the operation progresses; there is no unconsciousness of the patient, no vomiting following the operation, no suppression of urine, no œdema of the lungs, the patient remaining unhampered to fight the toxæmia.

Technic of the Local Anæsthesia.—In order to secure easily a sterile solution of cocaine of the required strength, all that is necessary is to boil in a proper receptacle one ounce of saline solution or one ounce of plain water; as the ebullition ceases, which it does at a temperature of 212° F., a tablet containing one grain of cocaine is dropped into the solution. The efficacy of the cocaine is not destroyed at a temperature below 212° F., but it will be seen that no pathogenic bacteria which might be contained in the cocaine powder could resist the action of such a temperature, and it has been actually demonstrated that a solution thus made is perfectly sterile; the strength of the solution is one-fifth of one per cent., and at least one ounce may be used without any danger to the patient.

Having prepared the field of operation, the line of incision is infiltrated with this solution of cocaine; the needle is passed into the skin but *not* beneath it, so that the injection is intracutaneous and *not* subcutaneous; the effect will be to raise a weal, as is shown in the accompanying drawing (Fig. 1). When this infiltration has been accomplished, the skin may be divided absolutely without the knowledge of the patient.

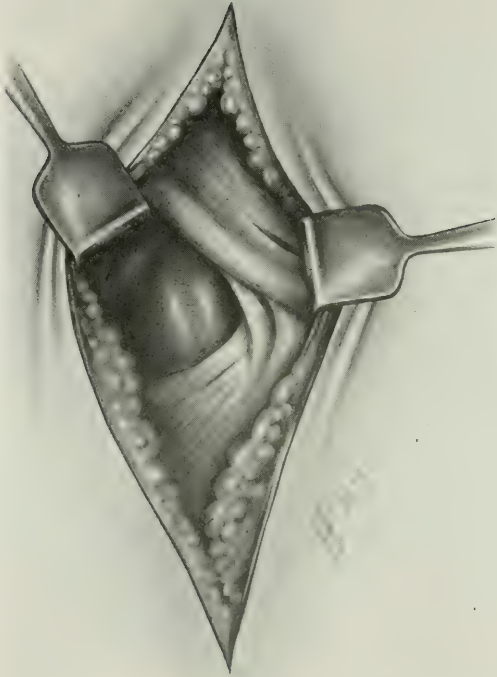
Incision.—The writer prefers the vertical incision, parallel to the femoral vessels and generally to the inner side, beginning one inch above Poupart's ligament and carried down as far as necessary over the hernial tumor; the incision varies from two to three inches in length. Many operators prefer an incision parallel to Poupart's ligament, slightly curved with the concavity upward, and extending on a line from a point two

FIG. 1.



Infiltrating the skin with cocaine solution along the line of incision.

FIG. 2.



Showing the structures concerned in repairing a femoral defect. Poupart's ligament lies anterior and superior; Gimbernat's ligament lies to the inner side of the canal and is covered by fibres of the iliac portion of the fascia lata; the horizontal ramus of the pubes covered by the origin of the pectineus muscle and its fascia lie behind the canal; and the sheath of the femoral vein lies to the outer side of the canal.

inches from the anterior spine of the ilium to the spine of the pubis. If the hernia is large and contains much gut and omentum, the incision must be changed to accommodate itself to the abnormal conditions. The skin and subcutaneous tissues are divided, the sac is separated gently from the surrounding tissues and freed as far as the femoral opening beneath Poupart's ligament; this may be accomplished painlessly without the use of any anæsthetic.

Technic of the Operation.—The hypertrophied adipose tissue which surrounds the sac is removed. The constriction of the sac usually takes place within the femoral canal formed by Poupart's ligament anteriorly, Gimbernat's ligament on the inner side, the pectineal fascia posteriorly, and the sheath of the femoral vessels externally (see Fig. 2). The sac of the hernia having been carefully isolated, it is drawn down and opened, and its contents noted. The femoral ring is carefully exposed, is injected with the cocaine solution, *and the constriction incised to allow drawing down of the strangulated gut, that it may be carefully examined before returning to the abdominal cavity.* One sees from the topographical anatomy that the points of incision should be anterior and internal in direction.

If there be any question as to the viability of the gut, the operation may be suspended at this point and the suspected gut kept warm by the aid of external agents for as long a time as it takes to satisfy the surgeon of its health or disease. The point of constriction of the gut should be carefully examined, because it is at this point that localized gangrene often occurs, which is accountable for a number of the deaths following the operation for the relief of this condition. If this be neglected and the gut returned to the abdominal cavity with a localized area of gangrene, the patient may seem to recover from the operation, passing small amounts of gas and fæces per rectum, but suddenly, in from four to seven days, there is collapse, the patient sinks rapidly and dies without warning. If the surgeon be sure that the gut is viable, the operation may proceed; the gut is returned to the abdominal cavity, the herniated omentum if hypertrophied or adherent, is removed, and the sac remains to be treated.

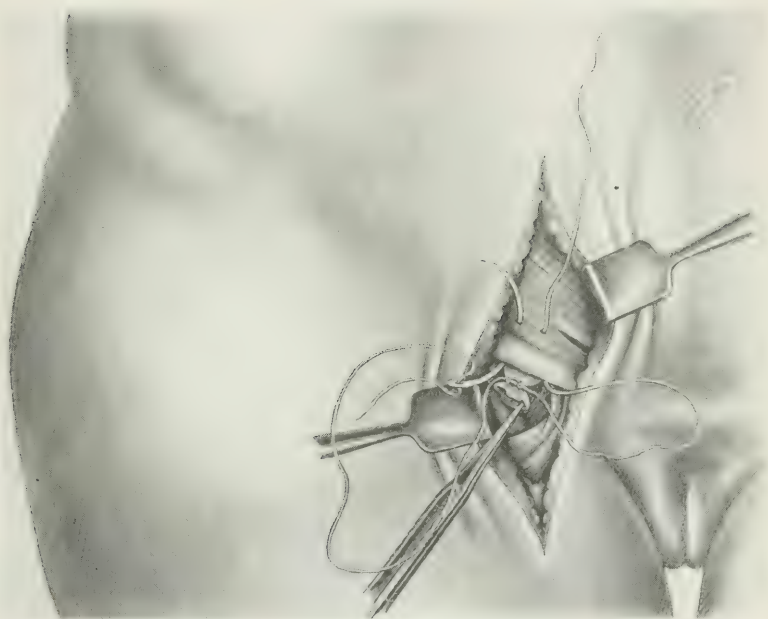
Disposition of the Sac.—The sac is drawn down as far as possible and its neck is transfixed with a heavy ligature of chromic gut or silk; the ligature is then carefully tied on one side of the sac and then on the other side, so that the ligature has transfixed the sac and is tied entirely around it, completely closing the peritoneal defect. The two ends of this ligature are then threaded on separate well-curved needles or aneurism needles, and the surface of the external oblique muscle above Poupart's ligament having been previously cleared, the stump of the sac is pushed up underneath Poupart's ligament with the forefinger of the left hand, and using this finger as a guide the needle is passed up and pushed through the overlying abdominal parietes above the level of the inguinal canal and the ligature is tied. In this way the peritoneal dimple at the inner femoral ring is obliterated, and the ring itself is blocked by a wad of cicatricial tissue (Fig. 3).

Closure of the Femoral Canal.—A single purse-string suture of silk or chromic gut is used for this purpose; the needle is first passed through Poupart's ligament near its attachment to the pubic spine; Gimbernat's ligament and the periosteum of the pubic bone are next included; the suture passes through the pectineal fascia and muscle, is carried across to include the sheath of the femoral vessels, and emerges again through Poupart's ligament; when the two ends of this suture are tied, the patency of the femoral canal is entirely obliterated¹ (Fig. 4).

If this method of suture be not feasible, the pectineal fascia and muscle are united to Poupart's ligament by interrupted sutures of chromic gut extending from the pubic spine to the sheath of the femoral vessels; this, however, takes a little more time. In some cases the hernia pushes down between Poupart's ligament and crosses over the sheath of the femoral vessels, producing a more extensive defect. In such a case, in addition to the purse-string suture as already described, it is necessary to attach Poupart's ligament to the muscular mass external to the femoral vessels, including the fascia lata (Fig. 5). In case the external inguinal

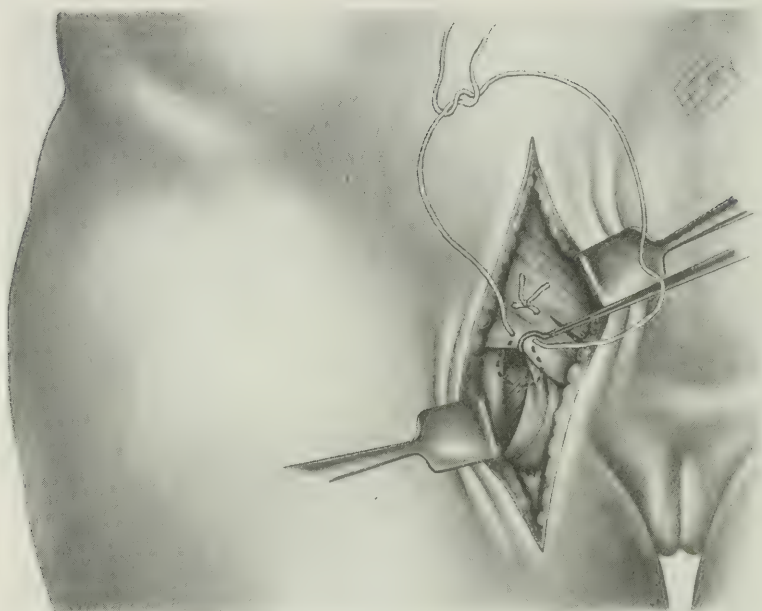
¹ Coley, ANNALS OF SURGERY, vol. xlv, 1906, p. 522.

FIG. 3.



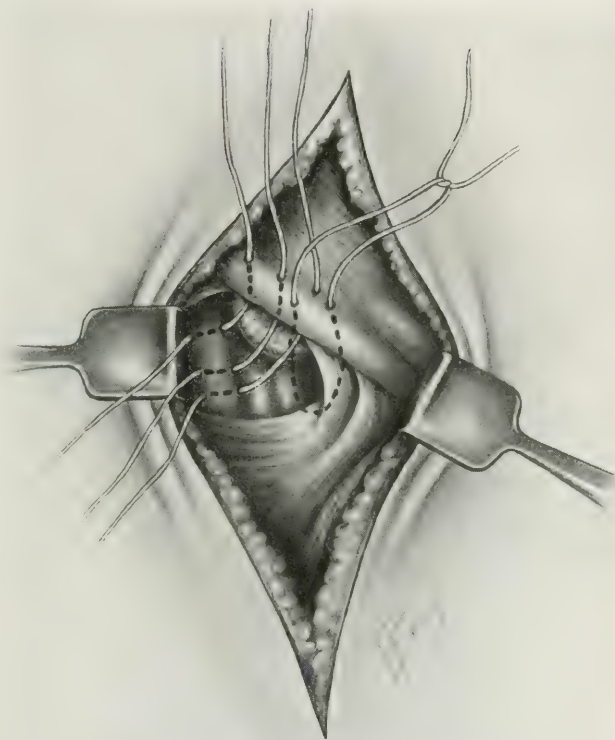
Disposition of the sac. After tying off the sac the two ends of the ligature are threaded on separate well-curved needles and the stump of the sac is drawn up and attached to the external oblique muscle as described on page 680.

FIG. 4.



Closure of the femoral defect by a single purse-string suture.

FIG. 5.



Showing an unusual form of femoral hernia described on page 680.

ring be enlarged, its pillars may be infiltrated with the cocaine solution and closed with two or three deep sutures of chromic gut. If an inguinal hernia be present, the incision may be carried up and a radical cure accomplished. If the patient's condition will not permit of the radical operation for the inguinal hernia, two or three sutures may be used to close the external inguinal ring, and one or two sutures may be used to narrow the inguinal canal without exposing the cord.

Closure of the Wound.—The wound is closed with interrupted silk sutures, without drainage.

It will then be seen that the procedure for the radical cure of femoral hernia in the aged is very simple, and consists of the following steps:

1. Intracutaneous injection of one-fifth per cent. solution of cocaine along the line of incision.
2. Incision, enucleation of the sac, and exposure of the femoral ring.
3. Opening the sac and inspection of the contents, incision of point of constriction, and return of intestines to abdominal cavity.
4. Transfixation and ligature of the neck of the sac with a single ligature, and fixation of the stump of the sac to the abdominal wall above the femoral ring.
5. Single purse-string suture uniting Poupart's ligament, Gimbernat's ligament, the pectineal muscle, and the sheath of the femoral vessels, obliterating the patency of femoral canal.
6. Closure of the wound.

The entire procedure is often accomplished with the use of about two drachms of one-fifth per cent. solution of cocaine, which contains about one-fourth grain of the cocaine. The patient is conscious, and is better able to fight the toxæmia. The procedure is very simple, needs few or no assistants, and can be done at the patient's home. Oftentimes no bleeding points need to be ligated, and the only foreign bodies are the ligature used to transfix the neck of the sac, the ligature closing the femoral canal, and the sutures closing the wound. It is therefore an operation peculiarly adapted to the aged, and results in a permanent cure of the hernia.

ACUTE DIVERTICULITIS.

BY HERBERT A. BRUCE, M.D., F.R.C.S., Eng.,

OF TORONTO,

Associate Professor of Clinical Surgery in the University of Toronto; Surgeon
to the Toronto General Hospital.

THE following case of acute diverticulitis, with perforation, occurred in a man aged sixty (M. O.), referred to me by Dr. G. W. Ross, by whom he was first seen on October 3, 1910. On this date he stated that in the previous June he had suffered from chronic constipation and "severe cramps." Ten days ago there was vomiting after food, and a few days later severe pain in the lower abdomen. On the previous evening the bowels were slightly moved by Kissingen water, but great pain resulted, with marked nausea after taking food of any description.

He complained of severe pain in the lower abdomen, most marked in the appendicular region, with rigidity of the right rectus and lower abdominal muscles, and rigidity and tenderness of the hypogastrium. On the following day the temperature was 99° to 101° , the pulse-rate below 100, and the leucocyte count 23,000. Most of the pain and tenderness were now referred to the hypogastrium and left iliac region, where a definite mass could be felt, the slightest movement of the abdomen causing severe pain. Urine contained albumin. Abdomen distended.

An incision was made in the middle line, and a large inflammatory mass found, extending from the middle line towards the left iliac region. The small intestines and omentum were matted together, and on insinuating the finger between the adhesions an abscess was opened and about two ounces of thick pus let out, and a drainage tube inserted. The sigmoid flexure could be felt forming the outer boundary of the abscess cavity. The appendix was sought for and found to be slightly inflamed, and was removed, as on account of the early history it was thought to be the beginning of the trouble. However, it was now quite clear that the disease originated in the sigmoid, and that we were dealing with a case of acute diverticulitis.

The patient became still more markedly distended after the operation, and we were unable to get the bowels to move. About thirty hours later the wound was opened up, the first part of distended bowel presenting drawn out, and a Paul's tube tied

FIG. 1.



Section of sigmoid opened, showing a number of diverticuli. *a*, abscess cavity outside sigmoid; *b*, a glass rod inserted through perforated diverticulum and into abscess cavity; *c*, enterolith in sigmoid; *d*, a number of diverticuli.

in. This, however, was not sufficient to relieve him, and he succumbed in twenty-four hours. An autopsy was performed by Dr. O. R. Mabey, who reports as follows:

The coils of small intestine were loosely adherent to the abdominal wound by fibrinous adhesions, and were covered by a fibrinous exudate and loosely adherent to one another. The Paul's tube was inserted into one of these coils, being held by sutures. There was an abscess cavity in the region of the sigmoid flexure four to six centimetres in diameter, and its outer and posterior walls were formed by the sigmoid and sigmoid mesocolon. The latter was covered by a thick fibrinous and partly organized exudate, and swollen and indurated. The inner and anterior walls were formed by the adjacent loops of small intestine.

On examination of the sigmoid after longitudinal section, *seventeen pouch-like projections were observed bulging into the mesocolon, and measuring from 2 to 5 mm. in diameter and 1 cm. in depth. A probe was passed through one of these from within the bowel into the abscess cavity.* Their walls were thin and apparently contained no muscle. Several of them contained hard fecal concretions and their walls were congested.

On microscopical section through the diverticuli their walls were seen to be composed of the mucosa, the submucosa, and the serosa. The tubular glands of the mucous membrane were fewer in number than normal, their lumina dilated, and their epithelium showed degenerative changes. The submucosa was infiltrated by moderate numbers of polymorphonuclear leucocytes, and a fairly large number of small mononuclear lymphocytes and eosinophiles. This inflammatory process at the base of the diverticuli extended for a short distance into the adjacent muscle.

Anatomical Diagnosis.—Multiple diverticuli of the sigmoid, perisigmoidal abscess, general peritonitis, and acute and chronic diverticulitis.

The accompanying drawing shows the condition very well. The probe passed through diverticulum, which had perforated.

Whilst operating upon a patient recently (Mrs. W., aged thirty-six), who had dense intestinal adhesions in the lower abdomen and pelvis, causing a very severe degree of chronic obstruction, I found a number of diverticuli of the small intestine above the obstruction. These diverticuli extended into the mesentery, and varied in size from that of a hazelnut to that of an almond. Altogether some twelve or fifteen were met with, situated at varying intervals of from four to eight inches apart. They were flask-shaped and empty, and it was quite clear that they were due to pressure from within the bowel, brought about by obstruction. They looked like hernial protrusions of the mucous coat through the muscular coat, with a very small aperture into the intestine.

In 1878 Chiari,¹ who examined 800 cases postmortem, found great variability in the depth of the lacunæ Morgagni, sometimes amounting to diverticuli, and in five cases a fistula was continuous with these. He considered these diverticuli due to pressure from within the bowel, similar to pressure diverticuli of the pharynx.

Graser² called attention to diverticuli of the large intestine due to deficiency of the muscular wall, owing to chronic congestion of the mesenteric vessels, and to diverticuli of the sigmoid causing inflammatory neoplasms.

Graser's diverticuli may occur in any part of the small or large intestine, and are congenital or acquired, the latter form being most common in the large bowel. They occur mainly in rows, at the sides of the gut or close to the mesenteric attachment, the commonest site being the appendices epiploicæ, and they may be the size of a hazelnut. When small they are semiglobular, but tend to become flask-shaped as they increase in size, and the aperture into the bowel is usually smaller than the maximum diameter of the diverticulum. They are not often found much above the middle of the descending colon, and increase in number and size from above downwards. They are usually full of fecal material.

They may be (1) of congenital origin, or (2) due to pathological causes affecting the intestinal wall. In 90 cases the average age was sixty, and about 65 per cent. are males. They are fairly common in connection with obesity. The normal sacculation of the colon is often exaggerated in constipation, and is sometimes found in association with these diverticuli. The longest retention of fecal matter is in this portion of the bowel.

Scheiber suggests muscular weakness or deficiency as the primary cause, Bier the "worked out" muscularis in senility in individuals who have been constipated or obese. The secondary pathological changes are atrophy of muscle fibres and of mucosal glands, difficulty in expulsion of fecal contents, tending to inspissation and concretions, and inflammatory changes in the sac wall due to bacteria. The direct results

are (1) tumor, (2) stenosis from cicatricial contraction and obstruction, (3) mimicry of carcinoma.

Neupert³ reports a case in which there was the development of a chronic suppurative process from perforation of one or more of such diverticuli into the mesosigmoid, with much connective-tissue formation and cicatricial contraction of the mesentery. At the operation inoperable carcinoma was diagnosed.

In ANNALS OF SURGERY for August, 1910,⁴ will be found a report of the microscopical examination of specimens from nineteen cases of intestinal diverticulitis, shown by Dr. J. A. Hartwell at a meeting of the New York Surgical Society.

Drs. Hartwell and Cecil⁵ compare the pathology of diverticulitis with that of appendicitis. Thus there "may be (1) acute inflammation without perforation, but with peritonitis by extension; (2) acute inflammation with perforation, which may result in localized abscess, general peritonitis, or abnormal communication with a neighboring organ, such as the bladder; (3) chronic inflammation without marked lesions, with temporary exacerbations; (4) chronic inflammation with considerable thickening of the walls; (5) possible development of cancer. The differences are that gangrene of the appendix is common, whilst that of a diverticulum has perhaps never been heard of; inflammation of the appendix affects the mucosa, whilst the mucosa of a diverticulum remains normal until perforation is imminent."

Clinically it will be difficult to distinguish chronic diverticulitis. Acute diverticulitis may be suspected when there is pain, rigidity, and tenderness in the lower left quadrant of the abdomen. The absence of diarrhoea or melæna will help to distinguish this condition from syphilis, tuberculosis, or cancer.

BIBLIOGRAPHY.

¹ Chiari: Wiener med. jahrbuch., 1878.

² Graser: München. med. Wochens., 1899, 721.

³ Neupert: Arch. f. klin. Chir., 1908, lxxxix, 399.

⁴ Hartwell, J. A.: ANN. OF SURGERY, August, 1910, 262.

⁵ Hartwell and Cecil: Amer. Journ. of Med. Sciences, August, 1910, p. 174.

APPENDICOSTOMY TO SAFEGUARD THE EX- CLUDED COLON IN LANE'S OPERATION FOR CHRONIC INTESTINAL STASIS.

BY A. E. ROCKEY, M.D.,

OF PORTLAND, OREGON.

To read Emil Metchnikoff's interesting book on "The Prolongation of Life" is to conceive a prejudice on the danger to health of harboring within the body a cesspool so vile as the colon. Follow this by reading Lane's monograph on the "Surgical Treatment of Chronic Constipation," and a ghostly procession of overlooked cases will pass in memory. The bad-breathed slaves of the anticonstipation pill, the Fletcherizers, the bran eaters, and the Carlsbad drinkers are there with the various ills produced by their slow poison.

I have one more charge to add to the indictment. Intestinal stasis may be an important factor in the causation of diabetes.

The colon is an economy dump whose function is to squeeze the last vestige of nutriment from the intestinal contents that are poured into it in a liquid state at the caput and in the cases under consideration only too often to be sluiced out at the other end by the enema syringe as a residue of hard lumps. That this function of absorption is a useful part of nutrition within proper limits is undoubtedly true. I am, however, quite in accord with those who believe that the dangers of its common perversion are vastly greater than we have suspected.

We know that the colon will absorb many quarts of normal salt solution, and this is representative of a useful function, but try ether vapor or an opium suppository and we quickly find that the colon is not discriminating and that deadly poisons are received with equal avidity. That pernicious substances are sometimes formed and reabsorbed within the body has been so often demonstrated that it is beyond dispute. I have a

number of times found a temporary glycosuria associated with intussusceptions. This disappeared promptly after operation. I have also seen it in severe obstipation. In one of the intussusception cases the condition represented perfectly a picture of diabetic coma.

In consultation I saw a girl of twenty-two who had rather suddenly become unconscious and had several convulsions. When I was called she was in profound coma. The catheterized urine contained sugar. Abdominal palpation revealed some distention and rather vaguely a mass on the left side. An immediate abdominal section revealed a long intussusception at the lower part of the ileum. It was resected and she made a slow and rather stormy recovery. The effects of the autointoxication were manifested by delirium, hallucinations, and great restlessness for more than a week.

Constipation so constantly present in diabetes has been regarded as a result. In the temporary glycosuria of obstruction, cause and effect are surely the other way. Why then may not the chronic autointoxication of habitual constipation be an important factor in the etiology of diabetes?

The occasional cases of malignant, tubercular, or inflammatory disease that have required resection of considerable portions of the colon have demonstrated to us that this apparently formidable operation may be safely done even under such adverse conditions.

In extreme cases of intestinal stasis with autointoxication, the colon may be resected as a primary operation. If I understand Lane rightly he admits a mortality of about 10 per cent. This is not an attractive constipation cure.

Fortunately he has given us the choice of a simpler method. By dividing the ileum near the cæcum, closing the cæcal end, and inserting the proximal end into the lower part of the sigmoid we may exclude the colon and cure the patient. Later in some cases he has found it necessary to remove the excluded colon, and while it is not commonly true he admits that hard substances may "form there." Most of us may believe that these may be fecal, backed up by a reverse peristalsis.

This was certainly true in the case of M. Maucilaire quoted by Metchnikoff.

After doing Lane's transplantation of the ileum several times, and I must admit always with benefit and never with any dire result as yet, but always with the possibility of fecal regurgitation in mind and the fear of a second and greater operation to urge upon a disappointed patient, it occurred to me that a simple appendicostomy would forever insure the safety of the excluded colon.

The first case in which I adopted this procedure was so typical in every way of the condition described by Lane that we may well use it as an illustration and quote it in detail.

CASE I.—Woman, age twenty-nine, tall, slender, married 12 years, two children 11 and 3 years of age; constipated since girlhood and for past four years in a very aggravated way; required constantly large doses of laxative, much troubled with bad breath, bad taste, bad dreams, cold hands and feet, a condition which was described as poor circulation. She had suffered much from abdominal pain, and had several attacks that were considered appendicitis. During the month previous to my first examination she had spent most of the time in bed, with pain on the left side, and came to examination with considerable discoloration of the skin on the left side of the abdomen produced by hot applications. At operation we found the condition typical of Lane's descriptions. There were numerous firm adhesions fastening the cæcum and the upper portion of the appendix well toward the outer wall. The same condition existed at the upper part of the sigmoid at the point where most of the recent pain had been felt. The transverse colon was elongated so that it reached well below the promontory of the sacrum. After severing the ileum and transplanting it into the lower part of the sigmoid, I detached the adhesions around the cæcum and appendix so that the caput of the colon might be brought well up against the abdominal wall. The operation was followed by an immediate amelioration of all symptoms and by regular daily evacuations of the bowels.

The method of doing appendicostomy which I adopted several years ago I described in a paper read before the Eastern

Oregon Medical Society, July 2, 1907. In doing it in association with this operation, the open abdomen admits of one slight but technically important variation in making incision for passing the appendix through the abdominal wall. As performed in conjunction with Lane's operation the procedure is as follows: Ligate the mesentery of the appendix with a strong catgut as for an appendectomy, being careful not to include the small artery running immediately along-side of the appendix. Leave the ends of the catgut six or eight inches long. Trim off the fat of the meso-appendix quite closely. The oozing points along the distal part may be disregarded. One or two points next the base of the appendix may be secured with very fine ligatures if they ooze much. If adhesions at the outer part of the cæcum are present in a manner to prevent easy approximation of the base of the appendix with the abdominal wall, they must be loosened before proceeding further with the operation.

Prepare for making the appendicostomy incision by grasping the right side of the abdominal wall in the hand, placing the thumb and index finger directly opposite each other at the outside of the rectus, thus bringing the thinner aponeurotic portion of the abdominal wall firmly in grasp at a place usually an inch or so below McBurney's point. Pass a narrow-bladed scalpel through the abdominal wall along-side of the finger from within outward. Fasten a long rather soft artery forceps to the scalpel blade on the outside, and draw the knife into the abdomen, pushing the forceps in with it. This manœuvre prevents the slipping of any of the tissue planes, and brings the forceps within the abdomen with the smallest possible incision. Grasp the tip of the loosened appendix and the ends of the catgut ligature on the mesentery with the forceps and draw out through the abdominal wall. Prepare a small roll of gauze about the size of the little finger and about three inches long, and fasten the tip of the appendix to the middle of the gauze with a stitch and roll it around the gauze until the caput of the cæcum is drawn up against the abdominal wall. Tie the catgut from the mesentery across the roll along-

side of the appendical curb, thus supporting the cæcum in position without tension on the appendix. The gauze is now bent in a horseshoe shape, and secured with a safety pin.

Under all ordinary circumstances this will finish this part of the operation. In case, however, the cæcum is much dilated and the appendix very small, it may be well to fasten the head of the cæcum to the peritoneum by a few accessory stitches.

The abdomen is now closed, and the wound is dressed in the usual manner. The part of the appendix where circulation

FIG. 1.

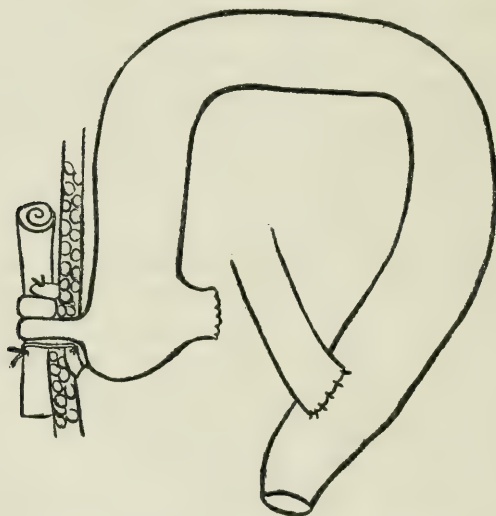


Diagram of the writer's method of appendicostomy.

is strangulated by being rolled around the gauze will shortly dry up in a flat ribbon. The proximal part, about one-third of an inch above the skin, retains vitality. The longer this is allowed to remain the firmer will be the adhesion and the less danger of the appendix drawing back below the skin after it is cut off. In my first operations I allowed it to remain about a week, but I prefer now to leave it alone for two weeks, and then at the time the wound is redressed and the stitches removed from the central incision I cut it off a little above the skin, and allow it to remain two or three weeks longer before

using it for irrigation. In cutting off the appendix care should be taken not to pull the gauze up enough to loosen the newly adherent appendix. Raise it only a little and slip the scissors under the gauze. This part of the operation is exceedingly important in order to secure a small duct-like opening which will not give trouble by leaking, and will remain free from any tendency to cicatricial contraction. Under no circumstances should the lumen of the appendix be dilated with a catheter or the integrity of the mucosa be endangered by pressure necrosis in wearing a tube. When done as described the appendectomy is not troublesome in any way. At most an occasional drop of mucus is secreted, and from this the under-clothing may be protected by pinning a folded handkerchief to the inside of the shirt.

For irrigating the colon I use the milk tubes which are employed by dairymen and veterinary surgeons in drawing milk from the udders of cows. They may be found at all dealers where veterinary instruments are kept. With one of these tubes attached to a fountain syringe holding a gallon of water, the colon may be flushed with great ease.

I believe that the adoption of this simple addition to Lane's operation will in all cases obviate the necessity either for primary or secondary resection of the colon. This communication must be considered a preliminary report. To what extent flushing of the excluded colon will be required, only a long and large experience will determine. That in many cases it may never be necessary is believed. Appendicostomy is proposed as a safeguard to an operation whose value as yet has received scanty recognition, but which I believe to deserve permanent place among the important surgical procedures. That it will be abused I have no doubt, and that it will be done by the incompetent I fear. In my title I have retained Lane's second choice of terms, agreeing with him, however, that neither intestinal stasis nor constipation fully indicates the condition to which this operation is applicable.

CHYLOUS CYSTS OF THE MESENTERY.

REPORT OF A CASE; OPERATION; RECOVERY.

BY W. H. AXTELL, M.D.,

OF BELLINGHAM, WASH.

I REPORT the following case, with references, for record because chylous cysts of the mesentery are of such infrequent occurrence that even standard text-books rarely mention them. I was unable to find mention of a single case in any of the standard works on surgery, the subject being simply alluded to in two instances. Park, in his surgery says that, "Chyle-cysts are rarely found in the mesentery and still less in other portions of the abdominal cavity."

Douglas, in mentioning mesenteric cysts in general in his "Surgical Diseases of the Abdomen," says that, "Angageur in 1886 found recorded only 19 mesenteric cysts; Moynihan in 1907 was able to gather only 113 cases; the latest statistics by Dowd makes reference to 145 cases. Tait in 2000 laparotomies did not meet with this condition; Spencer Wells found only two cases." In these cases of mesenteric cysts no mention at all is made of chylous cysts.

A list from the files of the Massachusetts General Hospital includes only 18 references. A letter from Grace W. Myers, Assistant Librarian of the Massachusetts General Hospital, says that the bibliography upon this subject is rather scarce.

CASE I.—F. S., thirty-two, German; married, five children. Patient had smallpox in 1902; he was always well until 1897, when, while attempting to turn a log with a canthook, with the handle resting on his shoulder, the weight of the log was suddenly thrown on the other end of the instrument, forcing him to the ground; he immediately complained of pain below the pit of the stomach. A few days subsequently he noticed a slight enlargement of the abdomen at the seat of pain. He was practically an invalid for a period of eighteen months, the swell-

FIG. 1.



Latero-anterior view showing globular form (half natural size).
a, continuation of glandular attachment.

FIG. 2.



Posterior view (half natural size). *a*, glandular attachment; *b*, portion of cyst along intestinal border between layers of mesentery. (Author's case.)

ing in the meantime gradually increasing. After eighteen months he slightly improved, and went to work as an apprentice cook. He remained comparatively well until about eighteen months ago, when he began to lose his appetite, lost weight, became anæmic; skin sallow; increasing difficulty in micturition; increasing and obstinate constipation; flatulence; increasing distress after eating; indigestion; pain in the pelvis; unable to sleep and increased weakness.

November 26, 1910, patient came to me for the relief of the obstinate constipation. Temperature normal; pulse 110; lungs normal; urine normal. Palpation of the abdomen revealed a large abdominal tumor, centrally located, extending from an inch above the umbilicus down into the pelvis behind the bladder; dulness on the left side extending from the left groin to the splenic flexure along the colon; the transverse and ascending colon were very much distended by gas.

Digital examination per rectum revealed besides an impacted bowel, a hard mass resting on the anterior wall of the rectum and the posterior wall of the bladder. By placing patient in the knee-chest position and using considerable force I was enabled to dislodge the tumor and push it out of the pelvis, thus removing the bladder or rectum from suspicion.

A sigmoidoscopic examination revealed the rectum and lower sigmoid impacted by hard scybalous balls; upon the removal of these the mucous membrane of the rectum was found suffused and inflamed; there was an acute flexure at the rectosigmoidal juncture, together with a considerable amount of thickening at the angulation. From the disengaging of the tumor and the cleansing of the bowel his general condition improved quite rapidly, gaining twelve pounds in three or four weeks.

The diagnosis of a cyst of the mesentery was made from the fact that the whole lower portion of the tumor was movable, the upper limit only being attached.

Operation.—January 11, 1911, with the assistance of my colleague, Dr. D. E. Biggs, laparotomy was performed. The tumor was brought into the incision in the abdomen, but being too large to extricate, it was aspirated until the tumor could be delivered. The fluid was milky white and, upon a subsequent microscopic examination, was found to be entirely chyle. The covering to the tumor was almost entirely from the inferior

layer of the mesentery of the upper part of the ileum near its juncture with the jejunum. The attachment was a little to the left of the spinal column. There was no particular difficulty in dissecting the cyst, although a portion of the glandular vessels was removed. The cyst contained two quarts, lacking five ounces. The accompanying drawings are self-explanatory and give a fair idea of the size and appearance of the tumor as it appeared filled with chyle.

Subsequent history.—The man left the hospital on the seventh day, apparently fully relieved of all the previous symptoms. However, the first two weeks after leaving the hospital he was practically unable to control the bowel movements or the bladder, and lost all that he had previously gained and several pounds besides; since then, however, by using appropriate abdominal supports, these difficulties have been overcome and he has gained rapidly; eats everything without distress; food well digested, bowel movements abundant and effective with no accompanying distress. At the present writing, March 3, 1911, the patient has returned to work and has gained all that he has lost, and says he feels better than he has felt for fifteen years.

Appended is a list of references to the literature on chylous cysts of the mesentery, which, I believe, contains a fairly accurate list of all the reported cases up to the present.

REFERENCES.

Books.

- Klefsch-Sillonville: *Kystes chyleux du mésentère*, Paris, 1892.
Schvartz, J.: *Chylangome kystique du mésentère*, Lausanne, 1904.

Periodicals.

- Beach, H. H. A.: *Chylous Cyst of the Mesentery; Laparotomy; Recovery*, Boston M. and S. J., 1898, cxxxix, 489.
Bramann, F.: *Ueber Chyluscysten des Mesenteriums*, Arch. f. klin. Chir., Berl., 1887, xxxv, 201-212.
Fawcett, J.: *Chyle Cyst of Mesentery; Intestinal Obstruction*, Tr. Path. Soc., Lond., 1901-2, liii, 406-408.
Fetherston, R. H.: *A Case of Chyle Cyst of the Mesentery*, Austral. M. J., Melbourne, 1890, n. s., xii, 475-479.
Floersheim, L.: *Kyste chyleux du mésentère simulat une occlusion intestinale; autopsie*, Gaz. d. hôp., Par., 1895, lxviii, 2-4.

- Hoover, T. C.: Removal of a Chylous Cyst of the Mesentery, *Tr. Ohio M. Soc., Toledo*, 1895, i, 263-365.
- Letulle, M.: Kyste chyleux du mésentère, *Bull. et mém. Soc. anat. de Par.*, 1899, lxxiv, 521-525.
- O'Connor, Chylous Cyst of Mesentery; Operation; Recovery, *Brit. M. J., Lond.*, 1897, i, 391.
- Rasch, A.: A Case of Large Chylous Cyst of the Mesentery, *Tr. Obst. Soc. Lond.* (1889), 1890, xxxi, 311-319.
- Rodriguez: Kyste chyleux du mésentère, *Bull. Soc. anat. de Par.*, 1891, lxvi, 661.
- Schmidt, R.: Lymph-respective Chyluscyste im Mesenterium, *Mitt. d. Gesellsch. f. inn. Med. u. Kinderh. in Wien*, 1904, iii, 91-93.
- Speckert, J.: Ein Fall von Chyluscyste, *Arch. f. klin. Chir., Berl.*, 1904-5, 998-1033, 2 pl.
- Wenning, W. H.: Chyle Cysts of the Mesentery, with Report of a Case, *Cincin. Lancet-Clinic*, 1894, n. s., xxxiii, 653, 664.
- Brinsmade, W. B.: Chyle Cysts of the Mesentery, *ANNALS OF SURGERY*, Philadelphia, October, 1908.
- Congdon, C. E.: Chylous Cyst of the Iliac Mesentery, *Amer. Jour. of Obstet.*, November, 1909.
- Porter, M. F.: Chylous Cysts of the Mesentery, *ANNALS OF SURGERY*, March, 1906.

REMOVAL OF THE URETER WITH A TUBERCULOUS KIDNEY.*

BY GEO. ERETY SHOEMAKER, M.D.,

OF PHILADELPHIA,

Gynæcologist to the Presbyterian Hospital; Consulting Surgeon to the Woman's Hospital of Philadelphia.

AN Italian multipara, thirty-five years old, was admitted, November 4, 1910, to the Presbyterian Hospital. She had been well until five months before, when frequent urination began, with pain in the bladder and right abdomen. Pain became severe, with irregular fever and sweating.

Examination showed a rounded tender mass extending an inch below the level of the navel in the right inframammary line, confirmed by the X-ray, which showed no stone. Left kidney not palpable. In the vagina a firm cord began abruptly forward and to the right of the cervix, passed outward upward and backward until it disappeared behind the uterus. On the opposite side no corresponding cord was felt in the region of the other ureter end. Uterus of normal size but carried bodily to the right of the median line. Hæmoglobin 73 per cent., leucocytes 11,500. Cystoscope showed capillary injection of the bladder, no growth and no deep ulceration. The left ureteral opening was to the right of the median line, being carried over with the uterus by intrapelvic inflammation and subsequent contraction. It was a well formed slit with flexible lips, and spouted blue urine freely within 18 minutes of injection into the buttock of 20 c.c. of water in which was dissolved a tablet of indigo-carmin. Farther to the right of it was a dark red, granulating patch, in the centre of which rose an irregular, yellowish white mass resembling a pile of small worms. This mass proved to be made up of cheesy casts apparently coming from a concealed right ureter. No blue urine escaped with this cheesy detritus.

Diagnosis.—Dead right kidney, ureter involved, probably tuberculous.

* Read before the Philadelphia Academy of Surgery, January 16, 1911.

FIG. 1.



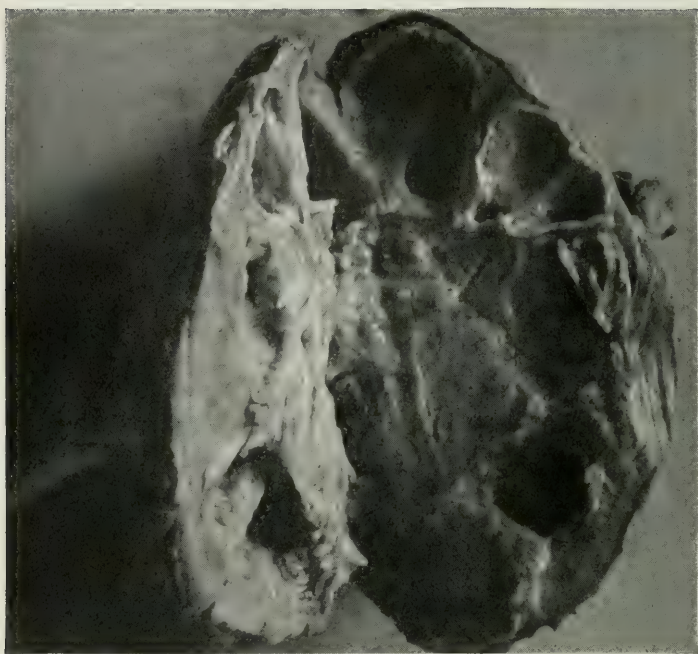
Five weeks after operation, showing location of incision (König).

FIG. 2.



Kidney irregularly distended with pus. The enlarged ureter is seen below.

FIG. 3.



Kidney bisected, showing pus pockets.

Operation (November 11, 1910).—(a) A vaginal incision one and a half inches long to the right and forward from the cervix exposed the cord-like ureter, which was isolated without difficulty by blunt dissection. Being quite rigid and fragile, it was unfortunately broken off while being hooked down. The short end was teased out until the bladder insertion rose as a cone on traction. It was tied off with catgut and cut away. The upper end was teased out well into the broad ligament and then temporarily left, a suture was placed in each end of the incision, and a wick of gauze inserted. The bleeding was slight.

(b) The patient was turned on the left side and an incision made opposite the navel, slightly inclined downward (Koenig). It extended back to the edge of the quadratus. Peritoneum pushed forward and inward, opened and no disease found in other regions, no fluid. Opening immediately sutured with catgut. Kidney enucleated around to the vessels, the cava was exposed, the vessels were freed from fat, and tied with chromicised catgut without bleeding. Pelvis rigid, as was the ureter. With gauze covered finger the pelvis and ureter were enucleated retroperitoneally from a bed or sheath of inflammatory tissue, the iliac vessels were exposed and passed, the dissection continuing through the broad ligament until the lower end was released where it had previously been freed below. No leakage of pus, no large vessels required ligature, no bleeding of importance. Wound closed over small tube drain. Convalescence uneventful. Gauze drain out of vagina in a week. Aseptic healing of abdominal wound, no sinus.

One month later weight had increased eight pounds, general improvement, the cystoscope showing the patch around the right ureter paler and flattened.¹

After operation the urine from the remaining kidney showed no tubercle bacilli, no pus, and no casts.

On section the pelvis and calices of the kidney were found filled with creamy fluid which yielded a pure culture of the *Bacillus alkaligenes*. In the laboratory of the hospital serial cross sections of the ureter were made at various levels. These sections as well as those from the kidney showed many tubercles and giant cells, with inflammatory infiltration. Diagnosis: tuberculosis of kidney and ureter.

¹ April 1, 1911, gain of 32 pounds within five months.

The operation of simultaneous removal of the kidney and ureter was first done by H. A. Kelly in December, 1895, Dr. A. J. McCosh operating a month later. In 1903 Dr. J. W. Bovee collected seventeen cases, and later² reported four others of his own. Operators have recommended various routes, transperitoneal or retroperitoneal; some working entirely from above, some reaching the lower part by a second incision near the semilunar line or in the vagina. Following Bovee I found the Koenig or transverse incision back from the semilunar line to give much easier retroperitoneal access than one in the loin, particularly as in this case the organ was prolapsed and well forward. Experience in many combined vaginal and abdominal operations for other conditions has convinced me that vaginal work should be done first, as the strain begins when the peritoneum is invaded above, and the patient should be returned to bed as soon afterward as possible.

Collated experience is proving that the ureter does not usually require removal in nephrectomy for tuberculosis. When, however, it is greatly enlarged and hardened all the way down, it is likely to give rise to a troublesome sinus if not removed. The ureteral catheter is not necessary even if it could be passed, as when the firm, hard cord can be felt in the vagina, no other guide is needed, and if this cannot be felt, the ureter may be left in, at least low down. After removal of the kidney which has been pouring infectious material through the bladder, the tendency of that organ to recovery is so great that it appears not necessary to remove bladder wall around the ureteral opening, unless the cystoscope shows deep invasion sharply localized.

² Jour. Amer. Med. Association, Oct. 23, 1909.

RESULTS OF THE USE OF THE MOORHOF BONE PLUG IN THE SURGICAL CLINIC OF THE UNIVERSITY OF MINNESOTA.

BY J. CLARK STEWART, M.D.,

OF MINNEAPOLIS, MINN.,

Assistant Chief of Surgical Clinic.

THE use of the Moorhof bone wax has revolutionized bone surgery in our clinic. We employ it in many ways not advised by its originator, and with such regular success that it seems difficult to see why others have troubles in its use.

In a late number of the ANNALS OF SURGERY Dr. Simmons gives an interesting account of the use of the wax in a restricted class of cases. His experience and conclusions differ so radically from ours that it seems wise to make a short report of our methods and results.

First, as to its field, we use it whenever we wish to fill any bone defect; in cavities made in healthy bone; in defects left by the removal of fragments in some compound fractures; in acute osteomyelitis both as a temporary filling to avoid gauze packing and as a permanent stopper of the evacuated cavity; in all forms of subacute and chronic osteomyelitis including bone abscess; in tuberculosis of both bones and joints.

Second, we regularly get union by first intention in most cases of chronic and subacute osteomyelitis and tubercular cases. In the more recent infective osteomyelitis, temporary drainage generally suffices to ensure the retention of the wax and closure of the wound over same.

Third, we have had no cases of extrusion of the wax or reopening of the wound and escape of serum and wax. On the contrary, wounds which have opened early from cutting out of stitches or tension, exposing the wax, have regularly granulated over the wax, leaving it *in situ* as shown by later skiagraphs. In a few very acute cases with infection of the

soft parts, the wax has been used as a temporary dressing, being replaced once or twice before the wound is closed over it. Our technic differs in these various cases.

In acute cases operated upon under Esmarch's ischæmia, the cavity resulting from the operations on the bone is merely mopped out with carbolic acid, followed after one minute by alcohol, then dried and filled with the Moorhof wax, and the soft parts sutured and drained before removing the Esmarch.

In less acute cases the same technic is used, except that the Esmarch bandage is removed and all bleeding checked before drying and filling the bone cavity. This is done by alcohol, pressure, and hot air, and the periosteum and soft parts are then closed without drainage.

While we have had a certain number of failures to unite by first intention, we have observed no cases of extrusion of the wax. The period of absorption of the wax varies; we have observed it as late as one year after operation, and in one case of normal cancellous bone noted below, there was very little absorption during this period.

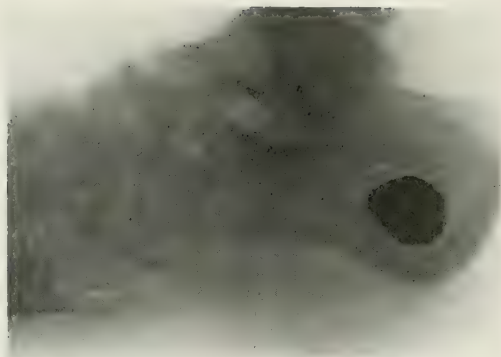
We have had no case of iodoform poisoning, although as high as one pound of the 40 per cent. wax has been used in a femoral cavity; but the urine has reacted for iodine in a few cases.

CASE I.—This skiagram shows a mass of wax in a cavity made in error in a healthy os calcis, over a year after its introduction. Scarcely any absorption. No opening of wound or extrusion. Case under observation since 1904.

CASE II.—No skiagram. Private case of Dr. J. E. Moore. Compound fracture of neck of femur by gunshot wound. Destruction of large part of great trochanter. Fragments removed and gap in femoral neck filled with bone wax. Superficial parts sloughed and suppurated; wax remained. Good union with slight shortening and good function.

CASE III.—Skiagrams of tibia. Boy four years old. Acute osteomyelitis of two months' standing, with discharging sinus near ankle. Operation showed destruction of lower end of tibia,

FIG. 1.



Cavity in os calcis filled with bone wax; condition one year after introduction of wax. (Case I)

FIG. 2.



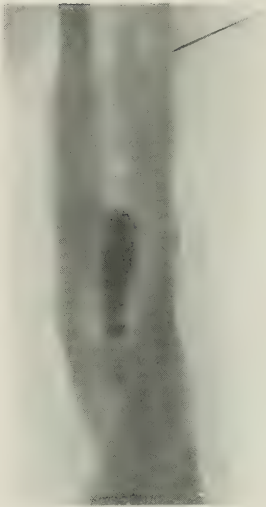
Lateral view through plaster cast of abscess cavity in tibia filled with bone wax. (Case III.)

FIG. 3.



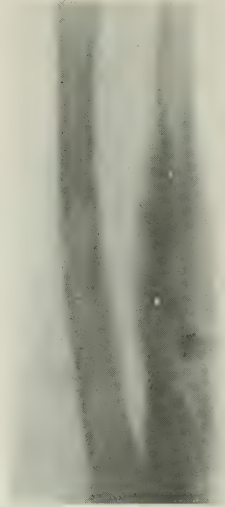
Anteroposterior view through plaster cast. (Case III.)

FIG. 4.



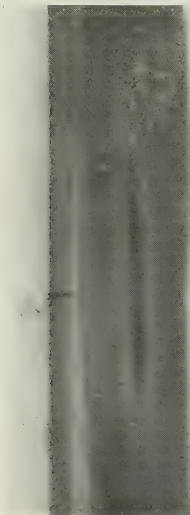
Abscess of humerus filled with bone wax.
(Case IV.)

FIG. 5.



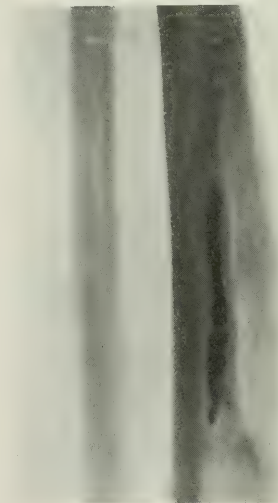
Abscess of ulna which had been filled
with bone wax: wax nearly absorbed.
(Case IV.)

FIG. 6.



Anteroposterior view of cavity in tibia filled
with bone wax. (Case V.)

FIG. 7.



Lateral view. (Case V.)

including all but a shell of the epiphysis, but with intact articular cartilage. Cavity scraped, cleansed, and filled with bone wax with temporary drain. Drain removed in one week; wound closed in two weeks. Skiagram three weeks after operation. Wound has remained closed since 1906. Good function of ankle-joint, and no deformity.

CASE IV.—Skiagrams of humerus and opposite ulna taken six weeks after operation. Multiple suppurative osteomyelitis in boy ten years old. Cavities cleansed and filled with wax with temporary drainage. No relapse or further discharge after four weeks.

CASE V.—Skiagrams of tibia taken eight and a half months after operation. Chronic non-suppurative osteomyelitis. Woman aged twenty-seven. Cavity six inches long filled with wax. No drainage. Skin tension caused opening of wound, which granulated over wax without loss of latter, as shown by skiagram. Skin now movable over bone, and the latter smooth without depression.

A FURTHER NOTE ON THE CLINICAL USE OF SCARLET RED AND ITS COMPONENT, AMIDO-AZOTOLUOL, IN STIMULATING THE EPITHELIA- TION OF GRANULATING SURFACES.*

BY JOHN STAIGE DAVIS, M.D.,

OF BALTIMORE,

Instructor in Surgery, Johns Hopkins University; Assistant Surgeon, Out-Patient Department of the Johns Hopkins Hospital.

Introduction.—In a paper published in the *Johns Hopkins Bulletin*, in June, 1909, and in the *ANNALS OF SURGERY* of January, 1910, I reported the results of my observations during the treatment of 60 cases with scarlet red in various combinations.

Since that time I have been impressed by the great interest in the clinical use of this dyestuff by the large number of papers on this subject which have appeared in the foreign journals, and also by a number of personal communications reporting favorable results.

The object of this article is to bring this subject up to date as far as possible, and in addition to make a few observations on the clinical use of amidoazotoluol, which was first tried by Hayward²² and is a component of the scarlet red originally used by Fischer.¹⁴

I was very skeptical when I began to experiment with scarlet red. It was difficult to believe that by the application of a commercial dyestuff such rapid epithelial stimulation could take place in sluggish wounds, some of which had been unhealed for many years.

It has been suggested that possibly the wounds healed with scarlet red were in a period of development in which, after being inactive for a longer or shorter time, the rapid epithelial growth would have taken place just as well under any other method of dressing. This may be true in a few instances, but I hardly believe it could have been the case in the large number of cases reported, where the process of healing had been at a stand-still until this dressing was begun.

* Read before the Johns Hopkins Medical Society, April 3, 1911.

Carrel, in his very interesting article on "The Treatment of Wounds" (*Jour. Amer. Med. Assoc.*, December 17, 1910, p. 2148), says that when at the end of the period of "granulous retraction" of a large wound the edges of the old epidermis are still at a distance of 20–25 mm., the new epidermis cannot spread on the granulations and the cicatrization of the wound comes to a stand-still.

Now, in practically all of the wounds which I have treated with scarlet red and amidoazotoluol, the period of "granulous retraction" had long since ceased, the period of epidermization had also come to a stand-still, and the areas were, for the most part, very large. In spite of these facts, in the large majority of cases there was marked epithelial stimulation from the hitherto sluggish edges following the application of the dyestuff, and subsequent rapid healing.

Scarlet red was used exclusively as a dye until 1900, when Michealis³⁴ found that this coloring matter was very suitable for staining fat in the cellular tissue for microscopic examination.

Experimental Use.—B. Fischer,¹⁴ in 1906, in a paper on the "Experimental Generation of Atypical Epithelial Proliferation," produced by the subcutaneous injection of a saturated solution of scarlet red, in olive oil, in a rabbit's ear, first called attention to the remarkable stimulating properties of this dyestuff, and suggested that therapeutic advantage might be taken of it. Since his publication a number of investigators (Ritter,⁴² Jores,²⁷ Geipel,¹⁵ Snow,⁴⁹ Stahr,⁵² Wyss,⁵⁹ Helmholtz,²³ McConnell,³² Seckel,⁴⁷ Hertzler,²⁴ Schreiber and Wengler,⁴⁵ Werner,⁵⁶ Enroth,¹³ Stoeber,⁵⁴ Grimani,¹⁷ Dixon,⁹ Cords,⁷ Meyer,³³ Borst,³ Wessley,⁵⁷ following Fischer's lead, have repeated his experiments and extended them. As far as I can ascertain all, with the exception of Snow, have agreed that a new growth of epithelium is produced.

Several kinds of animals have been used, rabbits, Belgian hares, guinea pigs, white rats, mice, monkeys, dogs, cats, etc. These proliferations have also been produced in man. Wessley⁵⁷ experimented on himself and Stoeber⁵⁴ upon a man

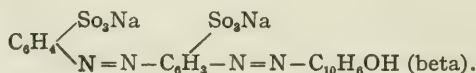
80 years old, whose leg was to be amputated for ununited fracture. The results were not as marked as in the rabbit's ear, on account of anatomical conditions, but were definitely positive. Stoeber injected scarlet red, amidoazotoluol and α -naphthylamin, but did not succeed in producing epithelial proliferation by α -naphthylamin. It is beyond the scope of this paper to discuss the theories as to the cause and source of these atypical epithelial proliferations.

An interesting point is made by Claribel Cone,⁶ who says that in the epidermis of man the fat which is shown by the scarlet red stain is especially noted in the basal (germinal) layer at the point of contact of the cell body and nucleus; in other words that the scarlet red attacks the living cell just at the point where physiological cell changes are most active. She suggests that this may cause a chemical or physical stimulation to the cell, and thus account for the active proliferation following its clinical use.

Chemistry.—In looking over the literature on the clinical and experimental use of scarlet red, I find that there are several chemically different dyestuffs which are marketed under the name scarlet red. I will consider the chemical formulæ of four of these.

1. The dye used in my series was the sodium salt of diazoazobenzene-disulphonic acid β -naphthol.

Commercial Names.—Biebrich Scarlet; Pouceau 3 RB; Pouceau B; Fast Pouceau B; New Red L; Imperial Scarlet. (Schultz and Julius " (Green), 1904, p. 110, No. 163.)



Method of Preparation.—Amidoazobenzenedisulphonic acid and β -naphthol. It is a red powder, soluble in water and slightly soluble in alcohol. Insoluble in ether.

2. Benzeneazobenzeneazo β -naphthol.

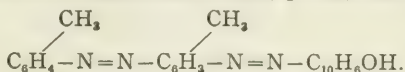
Commercial Names.—Soudan III; Cerasine Red. (Schultz and Julius, p. 106, No. 143.)



Method of Preparation.—Amidoazobenzene and β -naphthol. It is a brown powder, soluble in alcohol and fats. Insoluble in water.

3. Tolueneazotolueneazo β -naphthol. This is the scarlet red originally used by Fischer¹⁴ and Schmieden.⁴⁴

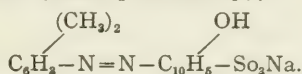
Commercial Names.—Oil Scarlet; Red B Oil Soluble Extra-concentrated; Pouceau 3 B. (Schultz and Julius, p. 108, No. 150.)



Method of Preparation.—Amidoazoorthotoluene and β -naphthol. It is a dark reddish-brown powder which cakes at about 175° C. and melts at 184° to 186°. Insoluble in water, soluble in alcohol and chloroform, fats, fatty oils, and also warmed vaseline and paraffine.

4. Sodium salt of xyleneazo β -naphthol monosulphonic acid.

Commercial Names.—Scarlet GR; Scarlet R; Brilliant Orange R; Orange L. (Schultz and Julius, p. 86, No. 54.)

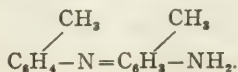


Method of Preparation.—Xylidene and β -naphthol monosulphonic acid. It is a cinnabar red powder, soluble in water.

I have used clinically the first three of these preparations with success, and also a xylidene scarlet (Schultz and Julius, p. 86, No. 55), which is closely related to the fourth preparation. I find the best and most consistent results with scarlet red have followed the use of the dyestuff originally employed by Fischer¹⁴ and Schmieden.⁴⁴ Hayward²² says that in the few cases reported where no result was attained, this special dye was probably not used. Hayward has also experimented with Soudan I, Soudan IV and Soudan G, with more or less success.

He says that Fischer and Schmieden thought that α -naphthylamin caused the epithelial stimulation in the most far-reaching way. Hayward used this substance clinically, and found that it caused only marked irritation. This was also my experience when I used β -naphthol ointment of a strength corresponding to that actually entering into the formation of 8 per cent. scarlet red, *i.e.*, 2.4 per cent.

Experimenting further, Hayward employed amidoazotoluol, the other component of scarlet red, and found that this substance caused a more marked stimulating effect on the growth of epithelium than did the scarlet red.



Method of Preparation.—Slowly add a saturated solution of sodium nitrate (1 mol.) to a mixture of orthotoluidine (4 mols.) and concentrated hydrochloric acid (2 mols.) and keep at a temperature of 30° to 40°. It is a reddish-brown granular powder. Melting point about 100°. Nearly insoluble in water but easily soluble in alcohol and ether.

Clinical Use.—A few words concerning the papers on the clinical use of these substances may be of interest.

Schmieden⁴⁴ was the first to follow Fischer's¹⁴ suggestion that scarlet red be used therapeutically, and in February, 1908, published a paper on his clinical results, which were very favorable. He reported rapid healing on sluggish ulcers of various kinds and in different situations. He used 8 per cent. ointment and alternated the dressing every 24 hours with some bland ointment on account of the irritating properties of the scarlet red. He also used with success adhesive plaster impregnated with 10 per cent. scarlet red for strapping leg ulcers.

He insisted that the granulations must be perfectly clean and flat, and said that it was useless to apply the ointment to an unclean ulcer. He noted that there was little chance of cicatricial contraction under this healing, and showed by microscopic examination that the newly-formed skin was the same as the normal skin.

In May, 1908, Kaehler²⁸ substantiated Schmieden's work and modified his technic. He found good results could also be obtained when scarlet red was used on unhealthy granulating wounds. He healed a varicose ulcer with scarlet red, and then was able to thoroughly clean up this new skin and operate through it for excision of varicose veins, thus showing the stability and quality of the newly-formed epithelium. He completely healed defects of similar size, one with grafts and one with scarlet red, in exactly the same time.

Krajča,³⁰ in September, 1908, described further good results. He was the first to use scarlet red in conjunction with Thiersch grafts, and found that the edges of the grafts were stimulated as well as the wound edges. He mentions a number of interesting cases. Some of the ulcers, although of large size, healed in a very short time under this treatment. He found the cutaneous irritation due to the scarlet red to be the exception rather than the rule.

Enderlen,¹² in September, 1908, published very satisfactory results, as did Cernezzi⁵ and Hübner,²⁶ in February, 1909. Wolfrom and Cords⁵⁸ in the same month wrote on the successful treatment of ulcers and wounds of the cornea by 5 per cent. scarlet red salve. Excellent results were obtained in a case of keratitis neuroparalytica. An old corneal fistula was closed by this means. A more rapid regeneration of the tissues was noted and sometimes an excess of tissue formation, but this soon flattened.

Sprecher,⁵¹ in March, 1909, reported good results in the treatment of ulcerated lupus vulgaris, ulcers of prepuce, vulva, labia, and cervix, varicose leg ulcers, syphilitic ulcers, ulcers of the breast, etc. He did not observe any local irritation or toxic effect in his series.

Rebaudi,⁴⁰ in April, 1909, described the use of scarlet red in gynæcological conditions, and obtained excellent results in the treatment of erosions, tears, etc.

Pleth and Pleth,³⁸ in May, 1909, detailed the successful use of scarlet red on ulcers of various kinds. Hermann,²⁵ in June, 1909, reported the success of his treatment with scarlet red of tympanic membrane perforations. He said the duration of the perforation seemingly had no effect on the rapidity of the healing. Suppuration did not appear during this treatment.

Ducros,¹¹ in July, 1909, reported favorable results on granulating wounds, as did Morawetz,³⁵ in September of the same year. Hayward²² wrote in the same month concerning the use of an 8 per cent. ointment of amidoazotoluol, which is, as we have mentioned before, a component of the scarlet red used by Fischer.¹⁴ His results on a number of granulating wounds were even more favorable than with the scarlet red, and he felt convinced that this was the stimulating portion of the dyestuff.

It does not seem possible that amidoazotoluol is alone responsible for the epithelial stimulation, as a number of observers, myself included, have noted very favorable results produced by the clinical use of dyestuffs which do not contain amidoazotoluol.

Grossmann,¹⁸ in December, 1909, reported favorable results with scarlet red salve, amidoazotoluol ointment, and amidoazotoluol gauze, in the treatment of wounds following operations on the nasal passages, and in perforated tympanic membranes. Halle²⁰ and also Levy³¹ said that they had been successful in similar cases with the scarlet red.

Hartmann²¹ and Beyer² stated at the same meeting that they had used scarlet red in a small number of cases without any particular success. Sonntag⁵⁰ and Brühl⁴ said they had failed to get rapid results in similar cases.

Auerbach,¹ in 1909, published a number of successful results in the treatment of ulcers occurring in skin and venereal diseases, varicose ulcers, etc. He was unsuccessful in only one case, a multiple leg ulcer which was complicated by extensive varices. The other leg of this patient had been previously amputated for leg ulcer. He used the treatment with success on wounds which were discharging copious purulent secretions. He had irritation with 8 per cent. scarlet red, so tried 4 per cent., which he found could be used continuously. Dauthuile⁸ also reported favorable results.

The papers which have appeared in 1910 are as follows: Rammstedt and Jacobsthal³⁹ mentioned excellent results in the healing of ulcers due to X-ray burns. Dreifuss¹⁰ reported favorable results in the treatment of granulating wounds. Cords⁷ said it was of use in the eye only in clean ulcers of the cornea, especially if there was deep loss of substance.

Pein³⁷ detailed a number of cases successfully treated with scarlet red, and gave a very interesting table of the measurements, taken from 25 leg ulcers, from the beginning of the treatment to the time of healing.

Strauss⁵⁵ published his very favorable results in the treatment of X-ray burns and other ulcers of various kinds. He says he does not value the use of scarlet red for the rapidity of epitheliation alone, which in some cases does away with the necessity of Thiersch grafting, but for the solid epithelium, which is of great value, especially in the region of the joints. By this healing, contractions and scar tensions can be avoided. Stein⁵³ reported good results in otiatrics. Scharezki⁴³ was

very successful in the treatment of skin defects of various kinds.

Katz²⁹ reported favorable results with 8 per cent. scarlet red and amidoazotoluol. Simin⁴⁸ had excellent results following the use of scarlet red.

Nance (*Jour. of Ophthalmology and Oto-Laryngology*, Feb., 1911, p. 41), reported very favorable results with scarlet red in the treatment of corneal defects.

It can be seen from the above that by the use of scarlet red and amidoazotoluol very satisfactory results have been obtained. The tone of nearly all of these papers has been enthusiastic, and the only unfavorable results are those reported by Hartmann²¹ and Beyer,² Sonntag⁵⁰ and Brühl.⁴ All of these were in aural cases.

Since the publication of my paper, I have continued to use scarlet red on a number of other cases with almost uniform success, and have little to add to the technic described at that time.

I find marked epithelial stimulation even when the wounds are unhealthy and the discharge is profuse. This has also been the experience of Kaehler²⁸ and Auerbach,¹ although nearly all the other writers, beginning with Schmieden, have stated that it is useless to apply the scarlet red ointment to any but a perfectly clean granulating wound. Of course the most rapid results are obtained on flat, healthy, granulating surfaces, but a great deal of progress can be made by its use while the granulations are being brought into this condition.

Strauss⁵⁵ objects to the use of scarlet red put up in balsam of Peru ointment, blue ointment, iodoform ointment, etc., as recommended by me, in the treatment of unhealthy granulating wounds, on the ground that the ointment is of no use on such ulcers, but my experience has evidently been very different from his. I consider the use of such combinations to be of value in the treatment of unhealthy granulating wounds, as the scarlet red in itself has no antiseptic qualities, and the cleansing process due to the balsam of Peru, etc., can in this way be carried on while the scarlet red is being used, as well as by the alternating dressing.

Technic.—An outline of the technic will suffice. Cleanse

the wound thoroughly with boric or salt solution and dry. Peroxide of hydrogen may be used before the boric solution if the granulations are unhealthy. The free use of nitrate of silver stick is advised to keep down exuberant granulations. Tincture of iodine, U.S.P. strength, may follow the silver nitrate or be used on alternating days, and is a powerful and rapid method of cleansing granulations.

The strength of the scarlet red ointment ordinarily used is 8 per cent., and it should be alternated every 24 to 48 hours with some bland ointment. By applying a weaker ointment, say 4 per cent., it can be used over longer periods without danger of the severe irritation which occasionally occurs.

The most satisfactory method of applying the ointment is as follows: Anoint the skin surrounding the defect with some bland ointment up to about one centimetre of the wound edge, as this prevents possible irritation. Then spread the scarlet red ointment in a thin layer on perforated old linen and apply to the wound, either along the edges or over the whole surface. A light dressing of sterile gauze secured by a bandage completes the procedure.

I have applied the scarlet red ointment to a number of wounds and then exposed them to the air and sunlight. The healing is very rapid and the drying out of the surface is most noticeable.

It is safe to use a 4 per cent. scarlet red ointment on partial skin grafts of all kinds 48 hours after grafting, and there is rapid stimulation of the wound edges and also of the grafts themselves.

Case Reports.—I will mention only one case to illustrate the efficacy of scarlet red:

A very feeble old lady, eighty-four years old, was badly burned across the shoulders six weeks before she came under my care. During that time she had been carefully treated by her family physician with the usual methods. The wounds had done well for several weeks, and then had become sluggish and no further progress could be made. The patient's general condition was bad on account of a weak heart and chronic nephritis, and was becoming serious under the strain. I was called to consider the advisability of grafting.

There were three ulcers, one over the right scapula, 5 x 10 cm., another over the left scapula, 5 x 8 cm., and a third ulcer 8 x 10 cm. situated in the midline between the other two. Those over the scapulæ were covered with clean but œdematous granulations, which had not yet reached the level of the skin. The central wound was still covered, to a large extent, by a slough which was made up of the whole thickness of the skin and some subcutaneous tissue. The epithelial edges of these ulcers were very sluggish.

On account of the condition of the patient and the situation of the wounds, I decided to try scarlet red instead of grafting.

November 26-27, 1910: The wounds were dressed with a balsam of Peru and castor oil mixture, 2 to 6.

November 28: Scarlet red, 8 per cent., was applied, and thereafter every third day, alternating with boric ointment.

December 7: The last of the slough was removed. December 16: The wound over the left scapula was healed. December 23: The central wound was healed. December 25: The wound over the right scapula was healed.

During the treatment the patient was in a critical condition almost continuously, and had to be strongly stimulated in order to preserve life.

The case is instructive from the fact that old age and great debility seem to have little deterrent effect on the stimulating power of scarlet red. The skin edges were stimulated in spite of the presence of a slough in the central wound. It was only necessary to use the scarlet red ointment in nine dressings to complete the healing. The result was a firm, thick, and stable skin, which showed no tendency to contract.

After the appearance of Hayward's²² paper on the efficacy of amidoazotoluol, I had the opportunity of using this substance on a number of granulating wounds of varying etiology. The results have been excellent.

Calculating the amount of amidoazotoluol in scarlet red from the molecular weights, we find that there is 3.76 per cent. of amidoazotoluol in an 8 per cent. scarlet red ointment. I have used this strength as well as 8 per cent. in simple vaseline, and also in the balsam of Peru and other ointments suggested earlier in the paper. I will illustrate the efficacy of amidoazotoluol by briefly reporting two cases.

CASE I.—A boy, fourteen years old, fell into the fire while in an epileptic attack and was severely burned. He was admitted to the hospital and was much improved, during his five months' stay, by grafting and various other methods. He was then sent to the Out-Patient Department for dressing, and as no further progress was made in the healing, he was referred to me eight months after the accident.

The size of the unhealed areas at this time can be well made out in the illustrations. The wounds were covered with very exuberant granulations which secreted actively. The epithelial edges were at a stand-still. The patient refused to be grafted, and it was decided to try 8 per cent. amidoazotoluol ointment. The granulations were trimmed off with scissors, then cauterized with silver nitrate, and this was followed by tincture of iodine. This procedure was carried out whenever necessary throughout the treatment.

February 24, 1910 (Fig. 1): All of the ulcers were dressed with amidoazotoluol ointment and this was alternated every 24 to 48 hours with balsam of Peru and oil, zinc oxide, or boric ointment. A stimulation of the epithelial edges was noticeable within 48 hours.

After the first dressing of the large areas with amidoazotoluol, a temporary change of color was noticed in the urine. The patient was dressed at 5 P.M. and the urine voided was as follows: February 24, 6.40 P.M., watery, 500 c.c.; 9.30 P.M., light lemon, 450 c.c.; February 25, 4.30 A.M., *amber*, 430 c.c.; 7.50 A.M., *reddish brown*, 240 c.c.; 11 A.M., *reddish brown, slightly darker*, 80 c.c.; 2.30 P.M., watery, 280 c.c.; 5.55 P.M., watery, 200 c.c.; 7 P.M., watery, 360 c.c. Otherwise the urine was negative. The subsequent dressings did not cause a change in the color of the urine.

May 9: The patient was discharged entirely healed. The healing was firm, thick, and looked like normal skin. Examination of this patient six months later showed a firm, movable skin, with normal sensation and no tendency to contraction.

CASE II.—A man, thirty years old, was severely burned by an explosion of oil. He came under my care on May 5, six months after the accident, and one of the unhealed areas is well shown in the figure. This wound had improved for a time and then had become sluggish, and apparently no further progress could be made from the epithelial edges. Several unsuccessful graftings had been previously done.

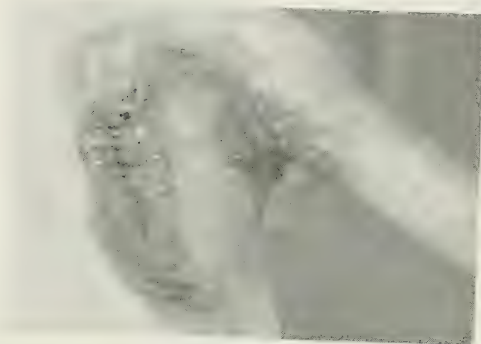
The wound was covered with oedematous exuberant granula-

FIG. 1

a.



b.

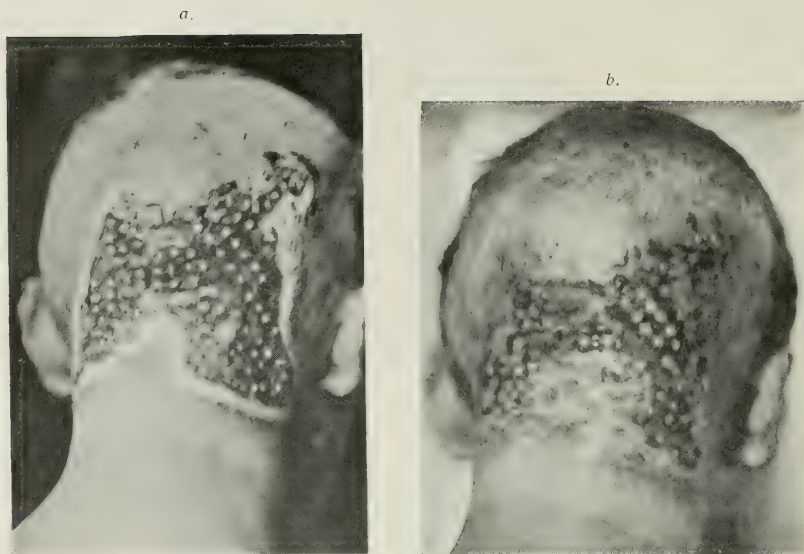


c.



Case I. Sluggish ulcers following burn. Healed with amidoazotoluol. *a.*, *b.* taken February 24, 1910, eight months after the accident. The ulcers are surrounded by scar tissue. There is partial web formation in the axilla. The exuberant granulations and sluggish wound edges can be well seen. *c.* taken May 9, 1910. Shows the character of the healing. There is no tendency to contraction. The web formation is less marked.

FIG. 2.



Case II. Sluggish ulcer following burn. Healed with small deep grafts and amidoazotoluol. *a*, taken May 30, 1910, six months after the accident. The ulcer is surrounded by scar tissue. The small deep grafts applied May 28 have all taken and the wound edges have begun to spread. *b*, taken June 4, 1910. Shows the very rapid epithelial stimulation from the grafts and wound edges after two dressings with amidoazotoluol. The entire wound is healed with the exception of a few small areas, whose aggregate size is not larger than a ten cent piece.

FIG. 3.



Case II. *a*, taken June 24, 1910. Shows the remarkable thickening of the grafts, which project like little warts above the skin level. *b*, taken August 9, 1910. The grafts have assumed the level of the surrounding skin. Considerable pigmentation can be seen in the healed area surrounding the grafts.

tions which were exquisitely tender. An effort was made to put the granulations in a healthy condition as soon as possible. Toward the end of this process 4 per cent. amidoazotoluol ointment was used as a dressing, and was followed by marked stimulation of the edges.

On account of the tenderness it was decided to graft. The patient refused to allow Thiersch or whole thickness grafts to be cut.

May 28: The granulations being in good condition, a number of small deep grafts were taken from the thigh under local anæsthesia and transplanted on the undisturbed granulations. The grafts were dressed with narrow overlapping strips of protective, over which was placed a dry dressing.

May 30: The dressing was changed, and all the grafts were found to have taken (Fig. 2, *a*).

June 1: The grafts were dressed with 4 per cent. amidoazotoluol on old linen. When the dressing was removed 48 hours later it was noted that the grafts were markedly stimulated. Dressed with boric ointment.

June 4: The entire wound, with the exception of one or two small areas, was covered with epithelium (Fig. 2, *b*).

June 11: The wound was entirely healed with firm resistant epithelium, which required no further dressing. Four applications of amidoazotoluol had been made. The grafts themselves had become much thickened and projected above the surrounding skin like little warts (Fig. 3, *a*). This condition disappeared, and the entire area assumed the normal level (Fig. 3, *b*).

Examination of this patient eight months later showed a firm, movable skin with normal sensation. There was still some pigmentation around the grafts, but this was less marked than at date of discharge.

Comments.—I was able to compare the rapidity of healing caused by scarlet red and amidoazotoluol. Following an extensive burn, there were two granulating wounds of about the same size. One was dressed with 8 per cent. scarlet red ointment and the other with 8 per cent. amidoazotoluol ointment. The healing in both was rapid, but the wound dressed with amidoazotoluol healed first. The character of the healing was practically the same.

The age of the patient seems to have little effect on the stimulating power of these ointments. The general health of

the patient is most important, and in some instances forced feeding, fresh air, and tonics must be resorted to.

It is interesting that a number of patients with exquisitely painful ulcers have remarked that there is less discomfort after dressing with these substances than after any other dressing, however bland.

In none of the cases have I noted the slightest irritation of the surrounding skin following the use of amidoazotoluol. Although this dressing can be used continuously without irritation, it is best to apply it for 48 hours and then alternate with some bland ointment for 24 hours.

Dressing with both substances causes excess of secretion for one or two applications, but there is marked drying out of the granulations in a short time.

The use of scarlet red and amidoazotoluol in blue ointment is advantageous in the treatment of syphilitic ulcers, and in addition constitutional treatment should always be employed.

In the treatment of second degree burns the ointment can be used immediately after the blisters have been cut away. In third degree burns it is best to wait until the granulations have started.

For a time after healing, the newly formed skin has a tendency to be dry and somewhat scaly, but this is easily overcome by the application of olive oil or vaseline.

I have not yet seen a wound break down which was healed by the use of scarlet red or amidoazotoluol, although some of the cases have been under observation for over two years.

A grayish membrane is often seen on the granulations after the application of scarlet red ointment. I have not observed this formation following the use of amidoazotoluol.

Thiersch and Reverdin grafts are sometimes tremendously thickened following early dressings with these substances, but this thickening disappears within a few weeks.

At times it is advantageous to apply either ointment directly to the wound and then expose to the sunlight and air.

Scarlet red and amidoazotoluol gauze is prepared by saturating gauze with a 4 per cent. or 8 per cent. alcoholic solution of the substances and then allowing it to dry.

The substances can be used as a dusting powder by the

addition of 4 per cent. to 8 per cent. strength to boric powder. I have also tried the full strength powder on a few wounds without irritation. The effect of the scarlet red and amidoazotoluol used in this way is very rapid drying out of the wound and the formation of a tough scab under which the healing takes place.

A simple and satisfactory method of preparing scarlet red and amidoazotoluol ointment is to rub up the substance with a small amount of almond oil until the mass is smooth, and then mix this mass thoroughly with the base.

Both these ointments can be sterilized without interfering with their stimulating properties.

As a rule there is no toxic effect either from scarlet red or amidoazotoluol. Gurbski¹⁹ reports the only case in which any general toxic effect was noted, as follows:

A child, eleven years old, was severely burned by an explosion of turpentine. The lower two-thirds of the thigh and the entire leg to the ankle were involved. After the granulations had formed Gurbski applied 8 per cent. amidoazotoluol ointment. Fifteen hours after the application the patient, who had previously been in very good health, began to complain of headache and dizziness. This was followed by violent vomiting and gastralgia. The pulse rose to 110 and was of low tension. The temperature rose to 102.38. There were cyanosis of the lips and albumin in the urine.

The dressing was removed and the patient placed on a milk diet. In a few hours all of these phenomena disappeared. Eight days later amidoazotoluol ointment was again applied and the same symptoms reappeared with the exception of the albuminuria. A third dressing five days later caused the same symptoms except that the vomiting was less marked.

During the rest of the treatment he applied the ointment to only one-fourth of the wound at a time, and the toxic symptoms did not again occur. Rapid healing followed.

Gurbski¹⁹ thinks the poisoning was due to the amido group in the amidoazotoluol.

I have dressed very large granulating areas for some time with these substances without any deleterious effect.

In this connection an observation by Stoeber is of interest. He says that it is not uncommon to have bladder disturbances among the men who work in the manufacturing of dyes. This trouble is principally among the workmen occupied in the

manufacture of amido combinations of benzol and naphthalin, or in factories where these products are used. The disease is characterized by cyanosis, vertigo and weakness, strangury, and bloody urine. In addition to the above symptoms, in long continued handling of these dyestuffs, hemorrhages and tumor formations in the bladder are observed. None of these symptoms have been noted following the clinical use of scarlet red or amidoazotoluol, except as noted above.

The consensus of opinion is that there is no danger of producing malignant growths by the clinical use of these substances. My own experience has convinced me of this, and although occasionally there is an overgrowth of epithelium, this soon assumes the level and the appearance of the normal skin.

Some authors have gone so far as to state that by the use of scarlet red and amidoazotoluol the majority of skin grafting can be eliminated. This is too broad a statement, but there is no doubt that wounds can be healed by these compounds which could not otherwise be satisfactorily closed except by grafting.

Scarlet red and amidoazotoluol will not heal every wound, but in the majority of cases, when applied with the proper technic, they will cause epithelial stimulation in the edges of the most sluggish wounds, and give a rapid healing which is stable and resistant, and which has the macroscopic and microscopic appearance of the normal skin. There is no tendency to subsequent contraction, and the skin becomes movable on the underlying tissues in a reasonable time. Any one of these characteristics would make the use of these substances well worth trying.

BIBLIOGRAPHY.

- ¹Auerbach: Ueber den Therapeutischen wert der Scharlachsälbe bei Haut und Geschlechtskrankheiten, *Klin. therapeutische Wochenschr.*, Nr. 14, 1909, p. 594.
- ²Beyer: Discussion of Grossmann's paper, *Deutsche. med. Wochenschr.*, Nr. 13, April 21, 1910, p. 777.
- ³Borst: Atypische Epithelwucherungen, *Deutsche. med. Wochenschr.*, Nr. 34, August 25, 1910, p. 1586.
- ⁴Brühl: Discussion of Grossmann's paper, *Deutsche. med. Wochenschr.*, Nr. 13, April 21, 1910, p. 777.

- ⁵ Cernezzi: Dell'influenza Eccitatrice avolta dallo Scarlatto R (Michaelis), sulla Rigenerazione dell'Epitelio Cutaneo, Gazzetta degli Ospedali e delle Cliniche, No. 14, February 2, 1909, p. 145.
- ⁶ Cone: Zur Kenntniss der Zellveränderungen in der normalen und pathologischen Epidermis des Menschen. Franzfurter Zeitschrift f. Pathologie, vol. i, 1907, p. 37.
- ⁷ Cords: Experimentelle und klinische Erfahrungen über die Wirkungsweise des Scharlachrot bei Hornhauterkrankungen, Klin. Monatsbl. f. Augenheilkunde, January, 1910, p. 1.
- ⁸ Dauthuile: Epidermisation rapide d'une vaste escarre gangreneuse de la face antero-externe de la cuisse gauche par des applications de Scharlachrot: Action remarquable de cette substance colorante sur les plaies atones, Nord. med. Lille, 1909, xvi, p. 169.
- ⁹ Dixon: Proliferations of the Epithelium Induced by Soudan III, Scharlach Roth, and Paraffin; and the Effects of Röntgen Irradiation on the Same, Jour. Infectious Diseases, vol. vi, No. 2, April 1, 1908, p. 205.
- ¹⁰ Dreifuss: Behandlung granulierender Wundflächen 8 per cent. Scharlachrotsalbe, Deutsche. med. Wochenschr., Nr. 1, January 6, 1910, p. 52.
- ¹¹ Ducros: Ueber die behandlung granulierender Wunden mit Scharlachrot., Deutsche. med. Wochenschr., Nr. 29, July 22, 1909, p. 1294.
- ¹² Enderlen: Empfehlung der Scharlachrotsalbe sur Beschleunigung der epithelisierung granulierender Flächen., Würzburger Aerzteabend., February 20, 1908; Münch. med. Wochenschr., Nr. 39, September 29, 1908, p. 2066.
- ¹³ Enroth: Epithelization of Granular Tumors by Scarlet Red, Finska lak.-sallsk. handl. Helisingsfors, 1909, ii, v. 2, p. 217.
- ¹⁴ Fischer: Die experimentelle erzeugung atypischer Epithelwucherungen und die entstehung. bosartiger Geschwülste, Münch. med. Wochenschr., Nr. 42, October 16, 1906, p. 2041.
- ¹⁵ Geipel: Artefiziell erzeugten Geschwülsten, Münch. med. Wochenschr., Nr. 21, May 21, 1907, p. 1057.
- ¹⁶ Gottheil: Scarlet Red, Pro. Med., vol. xii, No. 3, September, 1910, p. 131.
- ¹⁷ Grimani: Studio Sperimentale sulle Proliferazioni dell'epitelio Cutaneo., Rivista Veneta di Scienze Mediche, T. 50, April 15, 1909, p. 289.
- ¹⁸ Grossmann: Erfahrungen über die Anwendung der Scharlach-R-Salbe (Schmieden), der Scharlachs albe (Hayward), und der Amidoazotoluol gaze (Epidermol gaze), in der Ohrenheilkunde, Deutsche. med. Wochenschr., Nr. 16, April 21, 1910, p. 777.
- ¹⁹ Gurski: Beitrag. zur giftigen Wirkung der Scharlachs albe, Zentralbl. f. Chir., Nr. 49, December 3, 1910, p. 1550.
- ²⁰ Halle: Discussion of Grossmann's paper, Deutsche. med. Wochenschr., Nr. 13, April 21, 1910, p. 777.
- ²¹ Hartmann: *Ibid.*
- ²² Hayward: Weitere klinische Erfahrungen über die Anwendung der Scharlachfarbstoffe und Komponenten zur beschleunigten epithelialisierung granulierender Flächen., Münch. med. Wochenschr., Nr. 36, September 7, 1909, p. 1836.

- ²³ Helmholtz: Experimental Epithelial Proliferations of Skin and Mucous Membranes, Johns Hopkins Hospital Bulletin, September, 1907, p. 365.
- ²⁴ Hertzler: The Etiology of Epithelioma; a Laboratory and Clinical Study, Jour. Amer. Med. Assoc., February 8, 1908, p. 425. The Etiology of Epithelioma, Jour. Amer. Med. Assoc., Dec. 31, 1910, 2290.
- ²⁵ Hermann: Scharlachrot bei Trommelfellperforationen, Deutsche. med. Wochenschr., Nr. 22, June 3, 1909, p. 977.
- ²⁶ Hübner: Aerztlicher Verein zu Marburg, December 16, 1908; Münch. med. Wochenschr., Nr. 8, February 23, 1909, p. 424.
- ²⁷ Jores: Ueber art und Zustandekommen der von B. Fischer Mittels scharlachöl erzeugten Epithelwucherungen, Münch. med. Wochenschr., Nr. 18, April 30, 1907, p. 879.
- ²⁸ Kaehler: Epithelisierung von Wundflächen unter Scharlachsälbe (Nack Fischer-Schmieden), Med. Klin., Nr. 22, May 31, 1908, p. 836.
- ²⁹ Katz: Ueber die behandlung granulirender Wunden mit Amidoazotoluolsälbe, Deutsche. med. Wochenschr., Nr. 36, September 8, 1910, p. 1665.
- ³⁰ Krajca: Zur epithelisierung granulirender Flächen durch Scharlachrot-sälbe, Münch. med. Wochenschr., Nr. 38, September 22, 1908, p. 1962.
- ³¹ Levy: Discussion of Grossmann's paper, Deutsche. med. Wochenschr., Nr. 13, April 21, 1910, p. 777.
- ³² McConnell: The Experimental Production of Epithelial Proliferation, Jour. Amer. Med. Assoc., November 2, 1907, p. 1498.
- ³³ Meyer: Experimentelle Epithelwucherungen. Ziegler's Beitrage z. pathologischen Anatomie und Allgemeinen Pathologie, B. 46, H. 3, 1909; Münch. med. Wochenschr., Nr. 8, March 8, 1910, p. 538.
- ³⁴ Michealis: Quoted by Reinhardt, Biebricher Scharlach R., Apotheker-Zeitung, Nr. 10, February 3, 1909, p. 90.
- ³⁵ Morawetz: Erfahrungen über die behandlung granulirender Wundflächen mit Scharlachrotsälbe, Therapeutische Monatshefte, Bd. 23, September, 1909, p. 479.
- ³⁶ Nietzki: Chemie der Organische Farbstoffe, 1901.
- ³⁷ Pein: Ueber die Behandlung des ulcus cruris mit Scharlachrot., Die Therapie der Gegenwart, March, 1910, p. 121.
- ³⁸ Pleth and Pleth: The Use of Fluorescent Salts (Eosin, Scarlet Red, etc.) in the Practice of Surgery, Amer. Jour. Surg., May, 1909, p. 162.
- ³⁹ Rammstedt und Jacobsthal: Ueber Schädigungen der Haut durch Röntgenstrahlen, Fortschritte auf den Gebiete der Röntgenstrahlen, B. 14, 1909-1910, p. 14.
- ⁴⁰ Rebaudi: Intorno alle utili Applicazioni Therapeutische dello Scharlachrot, La Ginecologia Moderna, April, 1909, p. 217.
- ⁴¹ Reinhardt: Biebricher Scharlach R., Apotheker-Zeitung, Nr. 10, February 3, 1909, p. 90.
- ⁴² Ritter: Atypische Epithelwucherungen die durch Injection von Scharlachöl am Kaninchenohr Hervoggerufen sind, Münch. med. Wochenschr., Nr. 11, March 12, 1907, p. 542.
- ⁴³ Scharezki: Zur Frage von der Bedeckung von Hautdefkten (Russki Wartsch, Nr. 21, 1910). Zentralbl. f. Chir., Nr. 32, August 6, 1910, p. 1061.

- ⁴⁴ Schmieden: Epithelwachstum unter Einwirkung von Scharlach R., Zentralbl. f. Chir., Nr. 6, February 8, 1908, p. 153.
- ⁴⁵ Schreiber und Wengler: Ueber Wirkungen des Scharlachöls auf die Netzhaut mitosenbildung der Ganglienzellen, Münch. med. Wochenschr., Nr. 35, September 1, 1908, p. 1854. Also, V. Graefes Arch. f. Ophthalmologie, Leipsic, 74, January, 1910, p. 1.
- ⁴⁶ Schultz and Julius: (Green.) A Systematic Survey of the Organic Coloring Matters, 1904.
- ⁴⁷ Seckel: Ueber experimentell erzeugte atypische Epithelwucherungen, Münch. med. Wochenschr., Nr. 4, January 28, 1908, p. 199.
- ⁴⁸ Simin: Das Scharlachrot als ein Epithelisation ver stärkendes Mittel., Zentralbl. f. Chir., Nr. 52, December 24, 1910, p. 1641.
- ⁴⁹ Snow: An Attempt to Produce an Atypical Epithelial Growth by Injection of Scharlach R. in Olive Oil, Jour. Infectious Diseases, vol. iv, No. 3, June 1, 1907, p. 385.
- ⁵⁰ Sonntag: Discussion of Grossmann's paper, Deutsche. med. Wochenschr., Nr. 13, April 21, 1910, p. 777.
- ⁵¹ Sprecher: Sul Valore Terapeutico del Scharlachrot, Gazzetta degli Ospedali e delle Cliniche., xxx, No. 28, March 7, 1909, p. 289. Also, Klin. therapeutische. Wochenschr., Nr. 13, March 29, 1909, p. 325.
- ⁵² Stahr: Atypische Epithelwucherungen und Karzinom., Münch. med. Wochenschr., Nr. 24, June 11, 1907, p. 1178.
- ⁵³ Stein: Ueber die Verwendbarkeit der Scharlachrotsalbe bei Ohrenerkrankungen, Monatschrift f. Ohrenheilkunde und Laryngo-Rhinologie, xlv, 2 Heft., 1910, p. 214.
- ⁵⁴ Stoeber: Experimentelle Untersuchungen über die erzeugung atypischer Epithelwucherungen, Münch. med. Wochenschr., Nr. 3, January 19, 1909, p. 129. Die erzeugung atypischer Epithelwucherungen durch Injektion von Scharlachrot und Amidoazotoluöl in das subkutane Gewebe des Menschen., Münch. med. Wochenschr., Nr. 14, April 5, 1910, p. 739.
- ⁵⁵ Strauss: Beitrag zur Kenntnis der Wirkung des Scharlach R. auf das Epithelwachstum., Deutsche. med. Wochenschr., Nr. 19, May 12, 1910, p. 895. Pansements des Plaies avec la solution de la Pommade Rouge R., Archives Générales de Chir., T. vi, August 25, 1910, p. 810.
- ⁵⁶ Werner: Ueber den Einfluss des Scharlachrotes auf Mäusentumoren. Münch. med. Wochenschr., Nr. 44, November 3, 1908, p. 2267.
- ⁵⁷ Wessley: Ueber die Wirkung des Scharlachrotöls auf die menschliche Epidermis (Selbstversuch), Med. Klin., Nr. 14, April 3, 1910, p. 542.
- ⁵⁸ Wolfrum und Cords: Ueber die Anwendung von Scarlachrot bei Augenaffectationen, Münch. med. Wochenschr., Nr. 5, February 2, 1909, p. 242.
- ⁵⁹ Wyss: Zur Wirkungsweise der scharlachöl Injectionen B. Fischer's Bei der erzeugung karzinomänlicher Epithelwucherungen, Münch. med. Wochenschr., Nr. 32, August 6, 1907, p. 1576.

AN IMPROVED DEVICE FOR TRANSFUSION.

BY HENRY H. JANEWAY, M.D.,

OF NEW YORK,

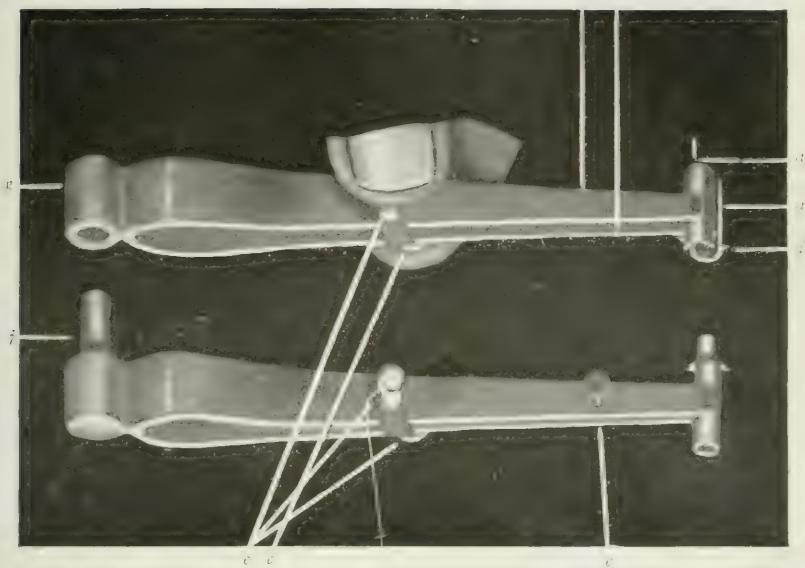
(From the Department of Surgical Research, Columbia University,
New York.)

THE accompanying figures illustrate an instrument which facilitates not only the direct transfusion of blood, but also the end-to-end suturing of blood-vessels. It consists of a male and female portion, each of which in turn consists of two small hemicylinders, *a a*. By means of the springy arms *b b*, these hemicylinders unite to form complete cylinders when the instrument is at rest, but are capable of being pressed apart by pressure upon the little knobs, *c c*, to receive between them the blood-vessels to be united.

The method of application is as follows: The artery or vein of the donor is ligated, and by pressure upon the knobs of the male part of the instrument the two halves of its cylinder are separated to permit the vessel of the donor to slip between them upon the proper side of the ligature. By relaxing the pressure the two halves of the cylinder spring together and surround the vessel. The latter is now divided a quarter of an inch in front of the instrument and a cuff from its cut extremity is turned back over the outside of the cylinder surrounding it, where the cuff remains held in place by the little pins, *d d*. The same procedure is repeated with the vein of the recipient.

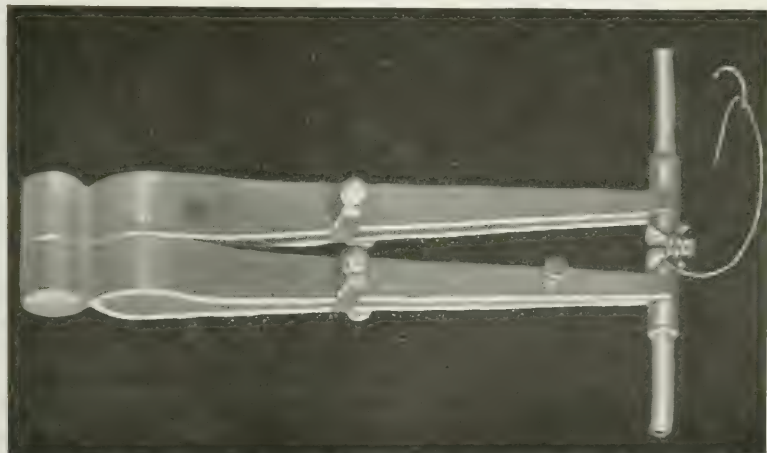
By engaging the shoulder *f* in the socket *g*, the male cylinder, which tapers somewhat so that it is a little smaller than the female cylinder, may be approximated easily within the lumen of the female cylinder and retained in place without support, allowing the blood to flow without leakage though no pressure is exerted to hold the two halves of the instrument together. When the vessels of donor and recipient are of

FIG. 1.

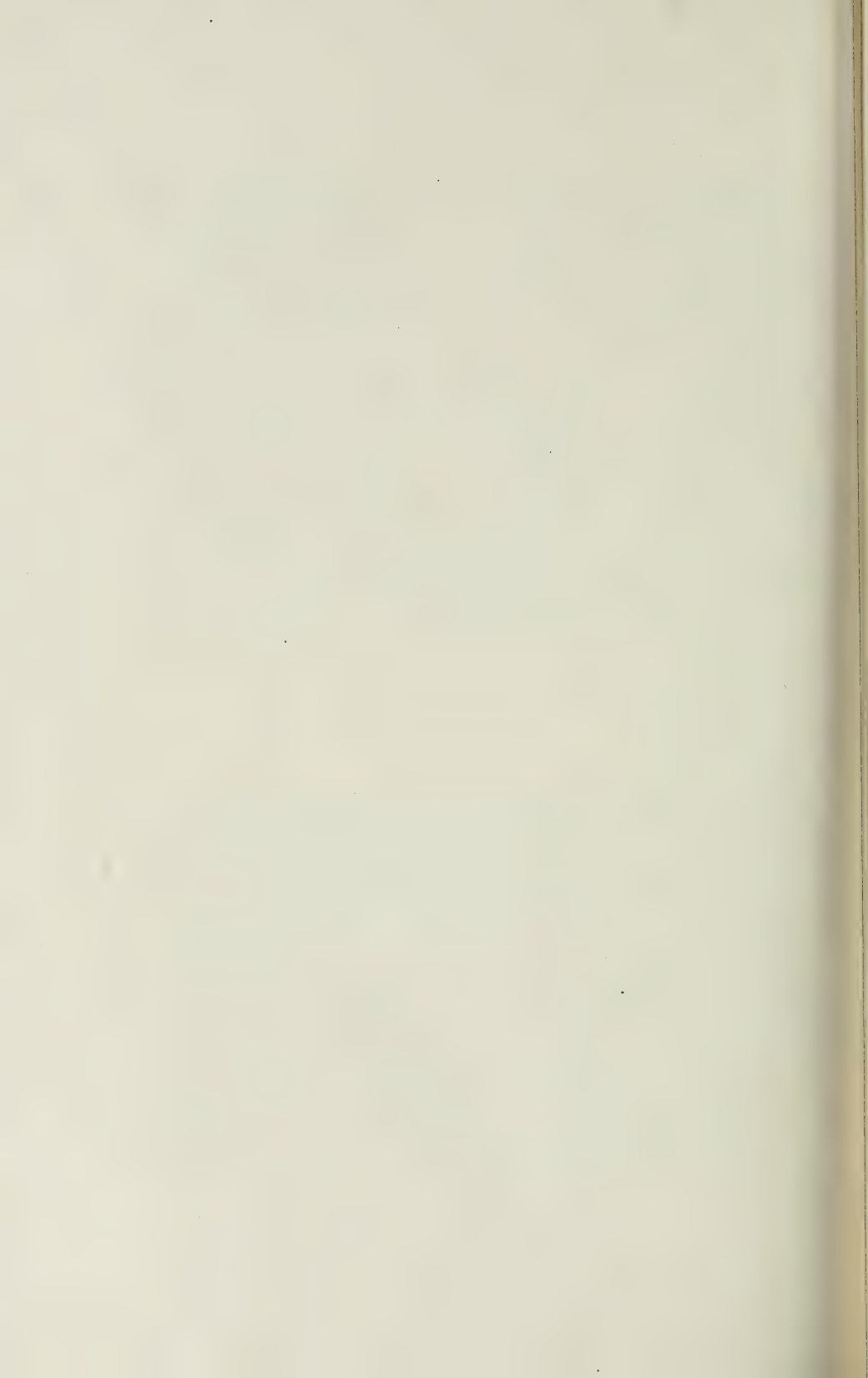


Male (below) and female (above) halves of the instrument. Hemicylinders *a a* separated by pressure on knobs *c c*. Points *d d* for catching turned back cuff of vessel. Screw *e* for gradually separating arms.

FIG. 2.



Suturing turned back cuffs together while blood flows.



very unequal size or in case it is desired to form a permanent union of thicker walled larger vessels the engagement of the male and female halves of the instrument can be facilitated by the use of a second thumb screw for separating the arms of the female half of the canula similar to the one indicated by *c*. This second thumb screw has lately been added to the female half of the instrument also. The thumb screw indicated by *e* in the male half of the device is used to secure a more rapid flow of blood by separating the arms of the hemicylinders and thus increasing the calibre of the vessel inclosed within them.* When the two hemicylinders of the male half are thus separated, they carry apart with them the hemicylinders of the female half, and when the device is in use with its hemicylinders thus separated, leakage does not occur.

If it is desired to use the instrument for making a permanent anastomosis between two segments of the same vessel or different vessels, such may be accomplished by merely suturing the two cuffs together over the supporting cylinders, as is illustrated in Fig. 2. This can be accomplished while the blood flows. After the suturing is complete the whole instrument may be removed by simply separating the two hemicylinders of each half of the instrument, and then the two halves from each other.

For the permanent suture of large vessels, different sizes of this device are desirable.

The students in the research laboratory have used this device for transfusion and for uniting vessels more easily than others at present in use.

* I am indebted to Dr. John A. Hartwell for suggesting the addition of this screw.

TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, held February 8, 1911.

The President, DR. ELLSWORTH ELIOT, JR., in the Chair.

FIVE CASES OF FRACTURE OF THE FEMUR TREATED BY THE OPERATIVE METHOD.

DR. JOHN B. WALKER showed these patients.

The first case was a woman, 26 years old, who slipped and fell, fracturing the neck of the femur. Two years after the occurrence of the accident she entered Bellevue Hospital. When standing, with the aid of crutches, the left lower extremity hung apparently helpless. The glutei and other muscles of the thigh on the affected side were moderately atrophied. There was 6 cm. shortening and a radiogram showed that the great trochanter was displaced far upwards. At the end of six weeks the continuous traction had diminished the shortening to 3 cm.

An operation was then undertaken to bring the separated fragments together and secure them in apposition. An incision was made, beginning 2 cm. below the left anterior superior spine, and extending downward and backward to the posterior margin of the trochanter, and then vertically down the thigh. The soft tissues were divided, then the capsule, exposing the fracture, which had occurred roughly transversely through the femoral neck, the proximal fragment consisting of the upper third of the femoral head. Considerable callus which was present was removed, and the fractured surfaces were freshened with the rongeur. By traction and abduction, and with great difficulty, the fragments were then brought into apposition.

A steel drill was passed through the great trochanter (the neck), the head, and into the wall of the acetabulum, thus spiking the fragments firmly together. The wound was closed, with a small rubber tissue drain, and a plaster spica was applied from

the lower border of the ribs to the toes. The wound healed uneventfully. The patient was confined to bed for eight weeks, and four weeks later a Thomas splint was applied and she went about on crutches, discontinuing the splint at the end of one year. Five months after the operation, the drill, which had become loosened, was easily removed.

Two years had elapsed since the operation. There was some motion at the hip, and less than 2 cm. of shortening existed. The patient walked without the aid of a cane, she was free from pain, and was able to support herself by doing regular work.

The second patient was a man, 40 years old, with a fracture through the middle third of the femur. When the dressings were removed, a month later, there was 4.5 cm. shortening, and only fibrous union had occurred.

Two weeks later, when Dr. Walker first saw the patient, the bone was exposed through an incision and considerable callus was present at the fractured ends. The fragments were freshened, and a quarter-inch intermedullary splint was inserted into the lower fragment; the upper fragment was then brought into alignment, and the splint pushed upward into the medullary canal for a distance of an inch and a half. The spica was removed six weeks later. Fifteen months after the operation, the patient was able to walk easily, without limping, and he had no pain.

The third patient was a boy, eleven years old, with an oblique fracture through the middle third of the femur with 3 cm. shortening, and a long side-splint and Buck's extension were at once applied. Ten days later the shortening still persisted, and the fragments could not be brought into alignment.

Fourteen days after the accident the seat of the fracture was exposed and the ends were found to be separated by a firm flap of periosteum, and they could be brought into correct apposition only after this flap had been excised. A steel plate was applied and secured by two screws inserted into the lower fragment. The shortening was overcome when the fragments were reduced. A plaster spica was applied and the patient was kept in bed for six weeks. Three months after the operation he was able to walk without limping or discomfort. Fourteen months had now elapsed since the operation and the steel plate had given him no trouble.

The fourth patient was a stout woman, 42 years old, with

a fracture through the upper third of the femur. Three hours after the accident she was brought to the hospital, and a long side-splint was applied. Three days later a radiograph was taken, which showed the usual deformity.

Six days after the accident Dr. Walker made a six-inch incision, exposing the seat of the fracture. The upper end of the lower fragment was found drawn inward and upward, while the lower end of the upper fragment was drawn upward and outward. There was a shortening of 4 cm. After considerable difficulty, and with very strong traction, the fragments were approximated. A large Lane plate was then applied, and fixed in position with six screws. The muscles and fascia were then united with fine catgut, and the skin with the finest subcuticular catgut suture. No drain was used. A plaster cast was applied from the pelvis to the toes.

Primary union resulted, and on the forty-second day the cast was removed. Six days later the patient was up in a chair and began to use crutches. Union was perfect, with less than 1 cm. shortening. Thirteen months after the operation the patient was able to walk without limping, and there had been no complication from the operation on account of the presence of the plate.

The fifth patient was a male, 16 months old, with a fracture of the upper third of the femur. When the infant was delivered by a midwife, the femur was fractured just below the lesser trochanter. No splint nor bandages were applied, and the fracture united with considerable angulation. The deformity had gradually increased, until there was about 2.5 cm. shortening.

Operation: A four-inch incision was made antero-externally. The femur was considerably thickened and increased in size, but no callus was present. The bone was sawn through, thus permitting it to be straightened and the divided ends to be accurately approximated. A small sized Lane plate was applied and held in position by four screws. The muscles and fascia were sutured with fine catgut, and the skin was united with a subcuticular catgut suture; no drain was used. A plaster cast was applied from the pelvis to the toes, and primary union resulted.

Ten days after the operation the plaster cast was removed and a new one applied. Thirty-five days after the operation, when the cast was removed, firm union was found to be present. The

patient was discharged from the hospital, and gradually began to walk, his gait becoming normal within six months. Fourteen months after the operation the child played with perfect freedom. There had been no complications.

In connection with this series of cases, Dr. Walker emphasized the fact that the operation should be done as soon after the injury as it could be determined that reposition was possible by no other method. It was better to clear out the clots at once than to wait for absorption, as it diminished the chance of sepsis. Traumatic reaction was going on all the time, so long as the bones were out of place, or so long as they were movable. The bone fragments injured the surrounding soft tissues, thus producing exudation and swelling. The longer the delay, the more the tissues contracted, and the chief difficulty in the reduction of fractures was the shortening of the tissues, which displaced the fragments.

Conclusions: The operative method was indicated: 1. For the immediate, accurate reduction of displaced fragments of long bones whenever it was impossible to correct the deformity without operation.

2. For the removal of soft parts between the fragments, which was the most frequent cause of non-union.

3. When properly performed with suitable instruments, it did not cause extensive laceration of tissue nor increase the risk of suppuration. It was absolutely necessary that an asepsis be observed which was far superior to that requisite for other operations, because a considerable quantity of metal was left in the wound. As these operations were usually very difficult, it was necessary that the surgeon and his assistants should acquire special skill.

4. It diminished the unfavorable results of conservative treatment. It simplified the usual treatment, for extension was seldom required and tight splinting was unnecessary. Physiological rest, so essential to rapid and uneventful healing, was frustrated by circular compression. It permitted earlier massage and passive motion, which was of so much importance in connection with joints in the earlier restoration of function.

5. It was *necessary* in fresh cases in which the fragments were irreducible or could not be moulded into place or kept in place after a fair trial, or in cases in which there was involve-

ment of the joints, with loose or unmanageable fragments, and in older cases of vicious union, with malposition of various kinds, which interfered with perfect function.

BILATERAL PNEUMOCOCCUS MASTITIS.

DR. JOHN F. ERDMANN presented a woman, 26 years old, whose last child was born five years ago. In October, 1910, she had an attack of pneumonia, and about a month later she developed an inflammation in the left breast. This was incised. Shortly afterwards, she noticed a small swelling in the right breast; this was excised, and upon examination proved to be an adenofibroma. A few days after the excision of this nodule, she developed a distinct inflammatory condition in the right breast, involving particularly the upper half of the gland. She consulted a prominent surgeon in this city, who pronounced it carcinoma. She then saw Dr. Erdmann, who suspected that the case might be one of pneumococcus mastitis, basing his opinion upon the preceding history of pneumonia, and a superficial patch of redness involving the breast. This diagnosis was verified by pathological examination, which showed pneumococci in pure culture.

The patient was operated on January 4, 1911, and was now entirely well. The changes in the breast proved to be purely inflammatory.

BREAST CARCINOMA IN YOUNG WOMEN.

DR. ELLSWORTH ELIOT inquired at how early an age carcinoma of the breast had been observed by any of the members of the Society. Personally, he had never seen it earlier than the age of 25 or 26.

DR. ERDMANN recalled one typical example of carcinoma of the breast in a married woman, 21 years of age.

DR. CHARLES H. PECK said he had had one case of carcinoma of the breast in a woman of 28, and that Dr. George E. Brewer had had one in a child of 11 years.

DR. FRANK S. MATHEWS said that in December last he had operated on a woman 25 years and 6 months old for recurrent carcinoma of the breast. The tumor had first been noted when she was 24 years and 3 months old. Her physician enucleated it through a small cut three months later; in three months more recurrence was noted. When Dr. Mathews operated, the axillary

nodes were not involved, but the growth, which had infiltrated the scar of the previous operation, was a typical carcinoma.

DR. A. V. MOSCHCOWITZ said he had operated on a woman of 22 with a rapidly growing carcinoma of the breast.

DR. ROBERT T. MORRIS said that recently, with Dr. Charles H. Walker, he saw a woman about 26 years old, who had a simultaneous involvement of both breasts. They were removed, together with the pectoral muscles and axillary glands. The operation was followed by a local recurrence in the neck and in the scar, and subsequently by further recurrences in the intercostal muscles and in the deep tissues of the neck. Shortly after the last operation the patient developed "pneumonia," which proved fatal. The pneumonia was regarded as the result of the malignant infection, the case apparently being one of rapidly developing general carcinomatosis.

A STAB WOUND OF THE HEART.

DR. ERDMANN presented this patient. This case was already on record, a report of it having appeared in *The Medical Record*, December 17, 1910.

In reply to a question, Dr. Erdmann said that he drained this case because the stabbing had been done with a dirty fruit knife. The drain was carried into the pericardial cavity. There was a good deal of compression of the heart itself, but no effusion into the pleural cavity occurred.

CARCINOMA OF THE STOMACH.

DR. JOHN F. ERDMANN presented a woman, 60 years of age who came to him with a history of carcinoma of the stomach and a palpable tumor in the epigastric region. She was admitted to the hospital on June 26, 1910, and on the following day Dr. Erdmann did a partial gastrectomy and pylorotomy. The patient's convalescence from the operation was uneventful; she was now able to eat practically everything, and had gained largely in weight.

The diagnosis in this case was adenocarcinoma, implanted, in all probability, on a previous ulcer.

PYLORIC STENOSIS.

DR. ERDMANN presented a woman, 31 years old, the daughter of the preceding patient, who gave a history of gastric ulcer with pyloric stenosis. In this case he did a typical posterior gastro-

enterostomy, making no effort to excise the ulcer. The operation was done on November 18, 1910, and since then the patient had been free from symptoms, and her weight had increased from 95 to 109 pounds.

PARTIAL GASTRECTOMY FOR CARCINOMA OF THE PYLORUS.

DR. ERDMANN showed a man, 48 years old, who gave a history of long-standing gastric disturbance, and examination revealed a slightly movable mass in the epigastric region. At the time of the operation, which was done on December 10, 1910, the man was in very poor condition. His weight was 129 pounds, and his hæmoglobin was reduced to 62 per cent. A partial gastrectomy and pylorotomy was done, over four-fifths of the stomach being removed. On January 25, 1911, the man's weight had increased to 137½ pounds.

SIX ABDOMINAL SECTIONS IN ONE PATIENT.

DR. ERDMANN presented a man 52 years old, who had never been ill until January, 1897, when he had a well-defined attack of appendicitis lasting about four days, after which he felt quite well. About a month later he had another attack very similar to the first, which lasted about the same time, and again he felt about as well as usual. On March 12, about a month after the second attack, there was a recurrence of his symptoms, and on the 18th he went to Dr. Keen's private hospital in Philadelphia, as he was now able to feel a distinct mass in the region of the appendix. On March 27, as his symptoms did not abate, Dr. Keen operated, opening and draining an appendiceal abscess; the appendix itself was not seen. Three days later, an abscess developed on the left side, which was opened and drained. A few days after this, a large fecal fistula developed in the first wound, which was operated on but without success. At this time, Dr. Keen said the patient had universal peritonitis. The right fecal fistula closed in December, 1897.

In June, 1897, a fecal fistula developed in the scar on the left side, which persisted several months. For about a year after these various operations, the patient felt a distinct dragging pain after emptying the bladder, which he attributed to an adhesion to the bladder. This symptom then disappeared, and

he thought nothing more about it until about seven years after the operations, when, one morning, upon urinating, a foreign body was expelled through the urethra, and upon investigation he found a calculus that had for its nucleus a silken knot, which must have come from the site of one of the previous operations.

Subsequent to this, with the exception of the slight annoyance caused by an incisional hernia on the right side, the patient was well until March, 1910, when he had an attack of questionable typhoid fever, lasting six weeks. On May 28, 1910, his hernia became strangulated and was operated on by Dr. Robert T. Morris.

On August 26, 1910, during Dr. Morris's absence from the city, he complained of symptoms which led to the belief that he had an abscess of the liver. Three days later Dr. Erdmann operated, and found a very badly matted in gall-bladder filled with pus; this was emptied, and the patient was put to bed. Subsequent to this he passed clay-colored stools, and showed evidences of pancreatic invasion. He returned to his home in Pennsylvania for a time, and when he returned, in October, 1910, his symptoms indicated an obstruction to the common bile-duct.

On October 22, Dr. Erdmann again opened the abdomen, doing a transduodenal operation and removing a stone from the duct. After this operation, the patient was in profound shock for 22 hours. His convalescence otherwise was very stormy, but he finally recovered entirely, and was now enjoying perfect health. His present weight was 190 pounds, a gain of 40 pounds since November 9, 1910.

DR. MATHEWS said he once contributed one to a dozen abdominal sections on the same patient. The early operations had been done in Spain for appendicitis, tuberculous peritonitis and Cæsarean section, and the later operations were for intestinal obstruction, the result of ubiquitous adhesions.

DR. ERDMANN said that speaking of operations from the numerical stand-point, he recalled the case of a widow upon whom he recently did the tenth. Some 4 others had done the other nine.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, January 16, 1911.

The President, DR. R. G. LE CONTE, in the Chair.

RECENT ADVANCES IN PULMONARY SURGERY.

DR. JOHN H. JOFSON delivered the annual oration before the Academy upon the above theme, for which see page 593.

DR. HENRY R. WHARTON said that most of the cases of lung injury which he had treated had been by the conservative method. He had seen a large number of very serious injuries of the lung recover. The majority of these cases were injuries of the chest from the passage over it of heavy wagons; at the Children's Hospital there were formerly a great many such cases, and although some of them died, quite a number of those even sustaining a rupture of the lung finally recovered. In adults he did not believe that the statistics of rupture of the lung complicated with fracture of the ribs are quite so favorable as in children. The last case under his care was an Italian boy at the Presbyterian Hospital, who had fracture of the ribs on each side, with laceration of the left lung, hæmothorax, pneumothorax, and extensive emphysema. Aspiration was done a number of times; this boy was desperately ill; finally a rib was resected so as to drain his chest on the left side where the rupture of the lung had occurred, and he recovered.

With regard to gunshot wounds of the lung, the majority of his cases had been treated on the expectant plan and had done well. The case to which the reader of the paper referred was that of a stab wound of the lung, which was aspirated several times on account of pneumothorax and hemorrhage; finally there was a resection of a rib for an empyema, with recovery.

SACRO-ILIAC ARTHRITIS FOLLOWING TYPHOID FEVER.

DR. WALTER G. ELMER reported a case which he believed presented certain features of interest, more especially in regard to the diagnosis. He also thought the lesion to be a rare one.

A young girl, nineteen years of age, was admitted to the surgical ward of the Presbyterian Hospital in the service of Dr. Oscar H. Allis on June 2, 1910.

During the preceding February and March she was quite ill with typhoid fever and was in bed for eight weeks. During her convalescence, about the middle of March, she developed swelling with severe pain of her right lower limb from hip to ankle. This swelling persisted for about six weeks, or until the first of May, when it subsided and all the pain became centred in the region of the right hip and back. Pain was worse at night, of a dull boring character, and patient had night-sweats.

On admission to the hospital, June 2, the temperature was 100°, pulse 112. After the first two days the temperature rarely rose above the normal and then only a fraction of a degree. At times the pulse was rapid. The patient complained of a good deal of pain in the back and right hip.

A physical examination of the heart and lungs revealed nothing abnormal. The kidneys were not unduly movable. The patient preferred to lie turned partly to the left side with the right limb slightly flexed.

At times the patient was seized with sudden, intense, agonizing pain, so great that she would give piercing cries, and then, making a brave effort at self-control, would lie moaning, her hands gripping the sides of her pelvis, tears running down her face, her whole body trembling and held rigidly in a fixed position apparently unable to move, and dripping with sweat. If any one approached her bed she begged that she should not be touched. The intense suffering was very real and it was quite pitiful to witness. There was no element of hysteria about it.

These attacks would sometimes come on at night, when the girl's cries would awaken and alarm the other patients in the ward. Hypodermic injections of morphia were necessary to give relief—sometimes two being required before the patient could relax. She would then suffer a good deal of pain for perhaps a day, it would finally disappear, and perhaps for days she would be quite comfortable. Then without any warning she would be seized with another attack of intense pain.

Pressure over the sacrum and right innominate bone revealed tenderness, and also if the patient made any pronounced voluntary movement, even though lying in bed, she had pain. Manipulation of the right limb showed that the muscles of the

lumbar spine and right hip were on guard and resisted movement. Side pressure upon the innominate bone caused pain in the lumbar region.

The lower limbs were equal in length. No abnormal mobility of the pelvic bones could be demonstrated. The urine showed a very faint trace of albumin, but was otherwise always normal and never showed any evidence of the presence of a renal calculus. The leucocytes ranged between 7550 and 7800. A differential count of the leucocytes showed nothing unusual. The hæmoglobin was 77 per cent. An X-ray plate of the lumbar spine and pelvis gave no assistance.

The patient had been placed upon a rather firm bed with fracture boards beneath the mattress; a folded sheet was placed under the hollow of her spine, and with this in position she could lie on her back with considerable comfort.

The speaker happened to enter the ward one day when she was in intense pain in the midst of one of her attacks. He turned her carefully on her back with the support under her lumbar spine, and slowly and forcibly flexed her thigh up to the full limit on her trunk. The movement gave her great pain. She cried out and was wet with sweat. Pretty firm pressure at the full limit of flexion, however, gave her relief from pain, and he was able then to slowly lower the limb until it rested on the bed beside the other one and the patient was relaxed and the suffering almost entirely relieved.

The indications for treatment were rest in bed for an indefinite period and nourishing food. The advisability of applying a fixation dressing was considered, but it was concluded to allow her to assume any position in bed which gave her the greatest comfort until the disease should run its course.

The patient continued to have attacks of pain at intervals of several days or a week. They grew less frequent, however, and less severe.

On August 7, a plaster jacket was applied, and the patient allowed to get up. She was discharged on September 5 still wearing the jacket. Two months later she had regained her normal weight, had a good color, and was in perfect health. Her plaster jacket had been discarded a month previously. She could go up and down stairs, stoop over and rise again, walk long distances, all without inconvenience, and had no symptoms whatever.

Here was a patient who, long after the acute symptoms of typhoid fever had subsided, suffered from excruciating attacks of pain, as agonizing in character as that caused by the passage of a gall-stone through the common duct or a renal calculus through a ureter.

The explanation of these attacks seems to be clear. The phlebitis of the right limb was in all probability a direct result of the typhoid fever infection, and it in turn resulted in an infection of the right sacro-iliac joint. The joint surfaces became exquisitely tender and sensitive to abnormal pressure. The ligaments of the joint had become relaxed as a result of the long illness which the patient had suffered, permitting an undue mobility in the joint. The acute arthritis caused the dull aching pain in the sacrum and lumbar region and hip and thigh.

During sleep, when the muscles were somewhat relaxed, and the patient perhaps turned in bed, the joint surfaces slipped slightly on each other, bringing pressure on acutely inflamed areas which had not been bearing it—then the intense pain, the waking of the patient, the sudden gripping of the muscles upon the bones as the reflex spasm returned with the added pain of the increased pressure, and the patient's body becoming rigid from the paroxysm of pain. If the joint surfaces could be restored to their normal apposition the pain promptly grew less, as was demonstrated on one occasion.

In due time the infection ran its course, the tender surfaces returned to their normal condition, the structures about the joint regained their normal tone, and the patient's recovery was complete.

THE SURGICAL ANATOMY OF THE PARATHYROID GLANDS AND ALLIED LYMPH-NODES.

DR. NATE GINSBURG read a paper with this title.

REMOVAL OF THE URETER WITH A TUBERCULOUS KIDNEY.

DR. GEORGE ERETY SHOEMAKER read a paper with this title, for which see page 696.

DR. JOHN B. SHOBER said that three years ago he removed a large tubercular kidney with a very much thickened ureter from a patient who had a persistent sinus following a psoas abscess opened five years before. Tuberculosis of the kidney, in his opinion, is a secondary process in the vast majority of cases, and the primary focus should be sought for and reported

more often than it is. This patient was operated upon in a similar manner to that described by Dr. Shoemaker, although the incision was more perpendicular, beginning at the costal cartilages at about the tip of the eleventh rib and following a line obliquely down about one inch inside Poupart's ligament. The peritoneum was reflected from the lateral and posterior walls, the kidney and ureter were located and removed with ease; the ureter was followed down to the broad ligament, then to the bladder, and then ligated as one ligates an appendix from the cæcum. It was quite easy to almost purse-string the stump of the ureter after it was ligated close to the bladder. This case was reported somewhat in detail before the Obstetrical Society of Philadelphia, in Feb., 1908, and published in the *Therapeutic Gazette*, June 6, 1908. The subsequent history is interesting.

About a month or two after the patient was operated upon, she developed symptoms suggesting a tuberculous pelvic peritonitis involving the Fallopian tubes.

Operation showed this was not the case, but there was a fibrous uterus with chronic inflammation of the tubes, necessitating hysterectomy. At the same time the appendix was removed. She made an uneventful recovery. At neither operation was the speaker able to follow the sinus which led to the vertebral column. It continued to discharge for a year or more. In the meantime patient had gained about 45 pounds. In order to cure the sinus he injected bismuth paste successfully. After injecting the bismuth vaseline paste he took an X-ray picture and found that the sinus led by a rather straight route to one of the lumbar vertebræ, ending in a bulb, which extended across the vertebræ to the opposite side.

It required ten injections of the paste to close the sinus permanently. However, about eighteen months ago another psoas abscess developed on the opposite side. This was promptly opened and treated by a few injections of the bismuth-vaseline paste, after which it closed permanently.

DR. GEORGE G. ROSS reported the case of a woman who had been suffering for six or seven years from a painful swelling in the right side of the abdomen. At the German Hospital, upon exposure it was found that she had a perinephric collection, which when opened, showed a collection within the kidney itself

and a large tuberculous ureter. The entire mass was adherent to the diaphragm, the posterior abdominal wall, and to the peritoneum in front. Recognizing his surgical limitations, he left the kidney in. She did very well for a while, draining urine and pus through the opening in the loin; the sinus healed and finally she got into such good condition that she started for home. She got as far as Baltimore, when the sinus broke out again; she returned immediately to the hospital and he again operated with the hope that the kidney had gone down to a size possible to remove. On exploration, however, he found practically the same condition as at the first operation. The kidney was smaller but still too large and adherent to remove. The sinus was dissected out and the kidney wound sewed up; patient had repeated ureteral catheterizations with washing out of the pelvis of the kidney. This was three years ago. She has now a perfectly functioning organ without sinus, pus, or discomfort. She has, however, a bad hernia.

DR. JOHN H. GIBBON thought that tuberculosis of the urinary tract usually starts in the kidney. Very often there is no evidence of inflammation of the kidney, nothing to indicate which is the kidney pouring the pus into the bladder, but the cystoscopic examination clears up the situation. If there is a tuberculous kidney there will not be a normal ureteral opening in the bladder. Occasionally we will have difficulty in making a cystoscopic examination. He encountered such difficulty some years ago in the case of a physician who had so much pus and blood in the bladder that he was unable to see the ureters. He did a suprapubic drainage of the bladder and examined it through a speculum and found extensive ulceration around the right ureter and around the base of the bladder but could not tell whether or not this involved the left ureter. He therefore followed Freeman's suggestion, that in order to make sure there was a normal kidney on the unsuspected side this kidney should first be exposed. Therefore, at a second operation he exposed the left kidney and found it to be perfectly normal. He then removed the right kidney but did not remove the ureter, and the abatement of symptoms was very prompt; before operation the patient voided urine every two hours at night and every half hour during the day, and before leaving the hospital, within two or three weeks, did not empty his bladder at all during the night.

The significant point here is that after the removal of a kidney which had been pouring pus into a bladder filled with ulcers, this bladder condition clears up. This seems to show that it is not necessary to remove the ureter unless it be very badly involved. The speaker said he had not taken out the ureter in tuberculous kidneys, nor sterilized it, but nevertheless the results had been good. If an ulcerated bladder will clear up after removal of a tuberculous kidney, the ureter also will do so provided we remove it as far down as possible. He had seen Mayo inject pure carbolic acid into the remaining portion of the ureter for sterilization. He said he had done it a great many times and had had no bad results. His feeling was that this might very easily cause a stricture of one part of the ureter and make trouble, but he had had no such trouble.

DR. GEORGE ERETY SHOEMAKER (in closing) said that in the diagnosis of these lesions the intramuscular injection of a color solution has a great advantage over the use of the catheter. He felt quite a little hesitancy in putting a catheter through an unsound field into what may be a sound field. If one will take the time to watch and count the spurts of colored urine, it is usually easy to recognize the kidney which is actively at work and compare it with one which is doing very little or nothing. So many accidental variations, such as clogging by minute clot or detritus, mechanical variations in calibre of the lumen, reflex inhibition, etc., affect the outflow that estimation of relative activity by the catheter is not reliable. Some tubercular ureters if not removed create a sinus, but fortunately most do not require removal.

ANNALS OF SURGERY

VOL. LIII

JUNE, 1911

No. 6

ORIGINAL MEMOIRS.

LARGE INTRATHORACIC CYSTS OF THE THYROID GLAND CAUSING DYSPNŒA.*

BY WALTON MARTIN, M.D.,

OF NEW YORK,

Associate Surgeon to St. Luke's Hospital.

NUMEROUS cases have been reported during the last sixty years of the development of goitre situated partially or completely within the thorax and causing dyspnœa by pressure on the trachea.

The cases of Bonnet,¹ of Lyons, were reported in an article on "The Goitres that Compress and Deform the Trachea," in 1851.

In 1879 Malard² took for the subject of his thesis "The Clinical Studies of Diving or Retrosternal Goitre."

Wührmann³ in 1896 collected the reports of ninety cases of intrathoracic goitre, and made a thorough study of the whole subject. His cases included cystic goitre, solid goitre, and carcinomata developed in intrathoracic thyroid glands.

The title of the thesis of Cadet, written in 1905, is "Endothoracic Goitre," and the work is devoted to diving goitre and to intrathoracic accessory goitres.

Among these reports are a few cases of large intrathoracic cysts developed in misplaced thyroid glands, and having had an opportunity recently of operating on a patient suffering from a similar lesion, I have thought it sufficiently interesting to report this case, to give abstracts of the reported cases of like

* Read before the New York Surgical Society, March 8, 1911.

nature, to call attention to the anatomical characteristics and the very striking clinical picture.

CASE I.—A. M., a native of the United States, twenty-one years old, printer by occupation, was admitted to Saint Luke's Hospital in the service of Dr. Hollis, on September 27, 1910. He was suffering from cough, headache, and difficulty in breathing. He said that for the past four years he had been very susceptible to attacks of bronchitis, the slightest exposure to cold or wet causing an attack. For the past two years he had been short of breath on exertion, such as going upstairs or walking up hill.

About a year and a half ago, while dressing in front of a mirror, he chanced to cough, and to his surprise saw a swelling rise above the right clavicle and then disappear. Each time he coughed the tumor appeared. He was stout and in good health, weighing 170 pounds, and except for the shortness of breath and slight headache from time to time, felt well.

He next noticed that his neck was increasing in size. He changed the size of collar from 14 to 14½, then to 15.

During the following year he had two severe attacks of bronchitis, with dyspnoea, wheezing, a persistent cough, and profuse mucopurulent expectoration. Since the last attack he had had increasing difficulty in breathing, and was blue and breathless after even moderate exertion. He was told by his friends that his voice had become harsher. The swelling in his neck increased. He now found it necessary to wear a 16 collar. The protrusion above the clavicle on coughing was more pronounced. He had consulted a number of physicians, and was told that he had a hernia of the trachea, and that this hernial protrusion filled up from time to time with mucopurulent material from the trachea and bronchi.

The present attack for which he was admitted to the hospital was similar to the others but more severe. The cough, dyspnoea, mucopurulent expectoration, and the wheezing were all present.

At no time had he had difficulty in swallowing, nor had he coughed up blood. There had been no soreness or pain connected with the swelling in his neck.

He had had the usual diseases of childhood and had had adenoids removed from his nasopharynx two years ago. Otherwise he had always been in good health.

On examination of his neck, a slight swelling was seen extending from the middle of the right clavicle across the middle line, filling up the episternal notch. On coughing, it grew suddenly much larger and then as suddenly receded again behind the clavicle. The top of the swelling was dome shaped and gave the impression that it extended behind the clavicle and sternum. It did not pulsate.

The swelling seemed to move with the movements of the trachea to some extent, moving up and down slightly on swallowing. The veins on the right side of the neck were engorged, the external jugular stood out as large as the little finger; the veins of the right side of the chest were also engorged. The throat appeared normal. The right pupil was slightly smaller than the left. There were numerous râles to be heard over both lungs, and the respiratory murmurs were harsher than normal. The heart was normal, the pulse regular and of good force, about 140, the respirations 30 to the minute, noisy and wheezing in character. There was moderate cyanosis. The temperature was 103.8°. The leucocyte count showed 16,900 white blood-cells, of which 78 per cent. were polymorphonuclears. The sputum showed the prevailing organisms to be a diplococcus resembling the pneumococcus.

During the next ten days the patient grew gradually worse, the dyspnoea became so severe that he was unable to lie down, the cyanosis and engorgement of the veins were more pronounced; his evening temperature varied between 104° and 105°; the cough and expectoration were very troublesome; he seemed to be losing flesh and strength rapidly, and was in a pitiable condition.

He was then transferred to the surgical division. The following night he seemed a little less uncomfortable but soon all his old symptoms reappeared. From the position of the swelling in its relation to the trachea, it seemed probable that he was suffering from an intrathoracic goitre, which was compressing the trachea and causing the dyspnoea, and it was obvious that unless he were speedily relieved he had not long to live.

Accordingly, under chloroform anæsthesia, a transverse incision about one inch above the clavicle was made across the neck, dividing the skin and platysma. The sternohyoid and sternothyroid were severed, and the sternomastoid strongly retracted. The dissection was carried upward and the superior

thyroid vessels ligated. The bleeding was very profuse from the engorged veins. Blunt dissection soon exposed the bluish wall of a cyst, covered by a thin mantle of thyroid tissue. The patient at this time was taking his anæsthetic badly, and the cyanosis was alarming. The cyst was punctured, allowing about half a pint of thin watery fluid to escape. The dyspnœa was immediately relieved. A Kocher clamp was then placed on the opening in the cyst wall and an attempt made to continue the enucleation. It soon became apparent that this was impossible, as the cyst extended far down behind the sternum and sternal end of the clavicle into the thorax. The upper free portion of the cyst wall was therefore removed, allowing again about half a pint of watery fluid to escape, and a soft drainage tube and a wick of gauze were inserted into the intrathoracic portion. The muscle and skin were then sutured, except for a small aperture for the passage of the tube. The cyst wall was extremely thin.

The duration of the operation was thirty minutes. The patient returned to the ward in good condition, the cyanosis had disappeared, and the respiration was no longer labored.

For several days the bronchitis continued. The temperature on the evening of the fourth day was 104° ; on the seventh day, however, it was 99.8° in the evening and from that time on he continued to improve. He weighed at this time 115 pounds, having lost during his illness 52 pounds.

During this week the dressing was saturated with thin serous discharge. The drainage tube was removed on the fifteenth day, the discharge having become much less, and he left the hospital on the twenty-second day with a small discharging sinus in the neck. He had gained in the three weeks 13 pounds, the temperature was normal, the pulse 108, respirations 24. During the next two weeks he was seen twice a week, and the sinus cauterized with 95 per cent. carbolic acid from time to time, a long probe being used as an applicator. It passed behind the sternum for several inches. At the end of this time the sinus closed, and he returned to his work. He now weighs 150 pounds, and is in good health.

CASE II (Reported by ANTHONY BOWLBY⁴).—A woman, thirty-four years old, was admitted to St. Bartholomew's Hospital, suffering from difficulty in breathing. She said that two years previously she first noticed a soft swelling in the episternal notch in the middle line of the neck, and that it had increased steadily and spread a little to each side.

Ever since the swelling began she had suffered from shortness of breath, and during the last six months had had occasional attacks of transient but severe dyspnoea. On admission she was suffering from such an attack, temperature was 103°, respirations 50, pulse 150.

Examination of the neck showed at first very little swelling. Such swelling as there was occupied the episternal notch and caused a prominence in this region instead of a depression, and extended laterally under each sternomastoid. When the patient coughed, however, the swelling increased in the most extraordinary manner, and a large rounded mass was suddenly extruded from the chest into the neck and then as suddenly disappeared. The way in which the tumor was projected reminded one much of the sudden protrusion of a large inguinal hernia during coughing. To the touch the swelling was smooth, rounded, and curiously soft. The tumor seemed to move very little on deglutition. An examination of the chest revealed a large area of dulness behind the sternum and cartilages of the first, second, and third ribs, and continuous with normal cardiac dulness. There were loud mucous râles in the trachea and bronchi.

At the operation a large cyst was exposed in the left lateral lobe of the thyroid. The cyst wall was exceedingly thin and extended behind the sternum beyond view. The cyst wall was incised; it contained about a pint of clear, almost watery fluid. "It had displaced the apices of the lungs laterally and extended down to the base of the heart. Its thin walls were reflected over the large vessels, so that on looking into the cavity one saw innominate, carotid, and subclavian arteries. The arch of the aorta was similarly prominent, part of the cyst passing in front of it and part behind, the floor of the cyst rested on the base of the heart, the pulsation of which could be easily seen." The walls were stitched to the skin around the episternal notch.

The patient made an almost uninterrupted recovery. The bronchitis persisted for a few days. The opening in the cyst closed in three weeks. There was no sign of refilling of the cyst. The case was reported in April, 1895. The case entered the hospital in December, 1892.

CASE III (Reported by BOUTARESCO⁵).—A woman, forty-six years old, married, was admitted to the hospital for an enormous tumor of the neck. She complained of oppression, tired easily, the breathing was short and insufficient. Her voice was hoarse, weak, and hardly understandable. She had pain in the right arm but no motor symptoms. The patient's condition was one of great weakness.

She presented two voluminous tumors of the neck. One occupied the anterior region, and extended from the hyoid bone to the sternum, behind which it disappeared, and between the two sternomastoid muscles. The second occupied the right supraclavicular hollow. The trachea and larynx were pushed strongly to the left. These tumors fluctuated. On puncture a brownish fluid was withdrawn.

In the first operation the lateral tumor in the supraclavicular fossa was removed; one portion of it was adherent to the pleura. At the end of the operation Boutaresco was not a little surprised to discover that there was not only no communication between the two tumors but that

they were separated by the carotid sheath. Seven months later the patient's condition continuing the same, Boutaresco proceeded to extirpate the median tumor. After exposure of the cyst wall, 300-400 c.c. was taken away with a Dieulafoy syringe. It soon became evident, as the dissection proceeded, that the tumor, instead of stopping at the episternal notch, extended far into the mediastinum behind the sternum, making it impossible to complete the enucleation of the cyst. The remaining portion of the contents of the cyst were withdrawn, the cyst wall widely opened, and the hand introduced to determine its relation. Much to his surprise the hand passed behind the aorta and heart, whose pulsation could easily be felt. Anteriorly the cyst wall followed the posterior surface of the sternum to the fourth costosternal articulation. The portion of the cyst in the neck was excised. The intrathoracic portion was drained after suturing it anteriorly to the margin of the wound. The patient made a good recovery. In two months the sinus had closed.

CASE IV (Reported by DEMME⁶).—A man, sixty years old, was admitted to the medical service of Würzburger Hospital suffering from difficulty in breathing. For some years he had been suffering from shortness of breath, transitory attacks of asthma, and violent fits of coughing.

His neck was short and thick. There was a moderate-sized goitre springing from the isthmus of the thyroid and passing beneath the sternum, under which it seemed to be drawn. This goitre decreased in size under treatment with potassium iodide, but the difficulty in breathing increased and he died in a few days.

At autopsy no goitre was visible above the sternum. The veins of the neck were moderately filled and dilated. The trachea and larynx were not displaced; the goitre of the isthmus, felt on admission to the hospital, had contracted down to a mass about the size of a hazel-nut, surrounded by connective tissue and situated on the trachea.

On removal of the sternum a large cystic goitre appeared. It extended on the left side from the third or fourth tracheal ring to the bifurcation. It was flask shaped. The neck-like narrowing, about 2.5 cm. in diameter, extended into the opening of the thorax. It was covered by the hypertrophied sternohyoid and sternothyroid muscles. The large vessels and nerves of the neck were not displaced. Immediately beneath the sternoclavicular joint and the sternal notch the cyst widened and soon reached a diameter of 7.5-8 cm. The anterior wall lay in immediate contact with the ribs and sternum, without being adherent. Its length was 12.5 to 13 cm. The base of the sac rested on the great vessels, but the arch of the aorta was not compressed. The innominate and subclavian veins, on the contrary, were narrowed and empty centrally, dilated and overfilled peripherally. The left upper lobe of the lung was compressed. The trachea was distinctly compressed from the fourth to the fifth cartilaginous ring to the bifurcation, in the upper part more laterally, from the sternal notch, however, from before backward; the narrowest point was at the first rib. The left bronchus was pale and displaced but not compressed.

The cyst wall was 4-5 mm. thick, and fibrous. The contents consisted of a purulent-like material composed of broken-down blood and colloid.

The tracheal and bronchial mucosa was loosened, reddened, and covered with mucus. These alterations were most marked below the narrowed portion.

CASE V (Reported by PROUST¹).—The patient was thirty-five years old. He complained of shortness of breath and the presence of a tumor in the neck.

The tumor lay beneath the sternomastoid and was of oval form. It extended from two fingers' breadth below the jaw to the clavicle, beneath which it seemed to pass. The superficial veins were enormously dilated. The tumor was movable laterally. It showed no pulsation, but was thrown up and down by coughing. It did not move on swallowing. Pressure over the tumor caused the patient to cough. It distinctly fluctuated. There was no difficulty in swallowing. The left carotid pulse could not be felt. When pressure was made gradually on the tumor it disappeared almost entirely. When the pressure was removed it slowly returned. The radial pulse was small and irregular. The patient gradually lost flesh and strength, and in about one month died.

At autopsy a spherical tumor was found. It extended beneath the left sternoclavicular articulation into the thorax to the second intercostal space, showing that the disappearance of the tumor on pressure had been due to its being pushed farther down into the thorax. It was about as large as the fist, and was formed from the left lobe of the thyroid and directly attached to the trachea. The trachea was considerably displaced but not narrowed.

CASE VI (Reported by DITTRICH²).—The clinical characteristics of this case had been reported by Singer two years previously. He suggested at that time as the most probable diagnosis a fibroma, which had its origin in the lung or pleura.

The patient had been under observation during the interval and had been admitted to the hospital at Prague for violent coughing attacks and hæmoptysis. At no time had there been any manifestation which would have suggested a connection between the tumor and the thyroid, such as a protrusion in the supraclavicular region, or a palpable connection between the tumor and the thyroid region.

The patient was a woman of sixty years, suffering from difficulty in breathing. There was a dulness on percussion over the upper part of the right side of the thorax. There was also enormous dilatation of the superficial veins in the region of the upper aperture of the thorax. There was absence of the pulse in the right carotid, and moderate widening of the right pupil. During her entire illness she had had attacks of bleeding from the lungs, and she died from such an attack.

At autopsy, on opening the chest, a tumor the size of a man's head presented, which occupied nearly the entire half of the thorax. It was a long oval mass, having an upper and a lower pole. Its surface was smooth. At only one point on the level of the first rib on the forward and outer part was there any attachment to the thoracic wall. The pleura

invested the tumor, being inverted by it, and was readily separated from it. Over the forward and upper pole ran the innominate artery and the right subclavian vein.

At the upper pole of the tumor was a reddish-brown mass which extended to the height of the third tracheal cartilage. This mass was gradually lost on the surface of the tumor as it passed downward, making a mantle-like covering. Above the third tracheal cartilage there was no thyroid tissue. On the left side was a well-developed lobe of the thyroid, reaching as high as the middle of the left side of the thyroid cartilage. Section of cyst showed that walls were about 5 mm. thick. It contained about three litres of a moderately thick, yellowish-brown fluid. Microscopic section showed the mass at the upper pole of the tumor to be made up of thyroid tissue. The isthmus of the thyroid had entirely disappeared.

The right lung lay compressed along the medial side of the lower part of the cyst.

The trachea was pushed to a moderate extent to the left along its entire length, and the right main bronchus seemed also pushed to the left and flattened. The mucosa of the latter was ulcerated throughout its entire extent. Examination for tubercle bacilli in the neighborhood of the ulceration gave negative result.

CASE VII (Reported by WÖLFLE⁹).—The patient was a man of twenty-six years. On the left side was a cystic goitre. On opening the cyst the finger passed into a large cavity which extended from the cricoid to far down beneath the sternum.

Anatomical Considerations.—The isthmus of the thyroid usually lies in contact with the three or four upper rings of the trachea. The entire thyroid may, however, be situated much lower, the isthmus reaching the sixth tracheal ring, and Nuhn¹⁰ observed a thyroid, otherwise normal, where the narrow isthmus lay behind the sternum, the left lobe was almost entirely behind the sternal portion of the sternocleidomastoid muscle; the right, more deeply placed, reached the upper border of the arch of the aorta, and its blunt end completely filled the angle between the innominate and left carotid artery.

In certain instances the neck is short, the larynx low, and the isthmus and lateral lobes are situated partly within the thorax. Kocher¹¹ calls this condition thyreoptosis.

An accessory thyroid gland may exist below the thyroid, within the thorax.

In any of these anatomical conditions a goitre developing within the gland may be situated partially or wholly within the chest. But in many instances the development of a retro-

sternal goitre seems to be due less to the deep position of the thyroid than to the circumstance that adenomatous material begins to grow from the lower border toward the retrosternal or retroclavicular space. The prolongation preserves a broad connection with the portion of gland from which it is derived, or the pedicle gradually stretches until it is reduced to some vessels and a layer of connective tissue, more or less thick, the vestige of the capsule. This extension is aided according to Kocher ¹² by two circumstances: first, the gland has a tendency to be sucked into the thorax during inspiration; second, the gland is forced into the thorax when the head is inclined forward.

Wührmann ³ found that the development of intrathoracic goitre from an accessory thyroid gland was exceptional. It occurred five times in his series of ninety cases.

A normal thyroid or a small goitre situated at the upper opening of the thorax can move up and down, lying now above and again below the aperture. As a goitre increases in size this excursion becomes less easy, and it may be caught below the opening and no longer be able to emerge in the neck, or certain manipulation, such as extending the neck or pulling on the pedicle, may be necessary to release it. The cases reported by Malard and by Bonnet are of this character. In most instances the goitre did not exceed in size a hen's egg. The incarceration of such small goitres may be followed by fatal results from pressure on the trachea, and the French writers of thirty or forty years ago drew attention to the disproportion between the size of goitre and the seriousness of the symptoms. Goitres which are freely movable, being at times intrathoracic and at times above the sternum, are called diving goitres (*goitre plongeant*).

On the other hand the goitre may pass within the thorax and continue to grow, causing for a long time few pressure symptoms, and being visible above the thoracic opening only during forced respiration, deglutition, and above all during coughing, or there is no evidence of a swelling above the clavicle or sternum. In this class belong the cases I have reported.

Symptoms.—The patient is as a rule an adult, and his chief

complaint is dyspnœa, at first noticed only after exertion, such as walking rapidly or going upstairs. It is progressive. He is very susceptible to attacks of bronchitis, and during these attacks the dyspnœa becomes much worse. The expectoration may be very profuse. There are wheezing and a very troublesome and persistent cough. The dyspnœa may be so severe that the patient is unable to lie down, sitting up all night in an arm chair like an asthmatic. There is little or no difficulty in swallowing. The voice is often harsh. The pupil on one side may be dilated. The patient gradually loses flesh and strength. The process in these large cysts is very slow, years not months intervening between the first symptoms and attacks demanding immediate relief.

There may be dulness on percussion over the upper part of the chest, extending at times to the third or even fourth space. The veins of the neck and chest are engorged. The carotid pulse may be absent. There may be abnormal sensations in the arm. On careful palpation of the trachea it is found to deviate from the middle line. In most instances a rounded mass can be felt above the sternum. It is smooth, compressible, and fluctuates. Coughing causes it to become suddenly prominent, suggesting the appearance, as mentioned by Bowlby,⁴ of an inguinal hernia when it is protruded by coughing. The mass may pulsate, but the pulsation is not expansile, and usually there is no murmur heard. By direct examination with the tracheoscope,^{13 14} one should be able to see the narrowing of the trachea, and the examination by the X-ray might be of great value.¹⁵

Diagnosis.—The symptoms recounted—cough and dyspnœa from pressure on the trachea or bronchi, paralysis of the recurrent laryngeal, widening of the pupil from pressure on the ocular pupillary fibres of the sympathetic, dilatation of the veins of the neck, weakness or absence of the carotid or radial pulse, and dulness over the upper part of the chest—obviously might be caused by any mediastinal growth, whether it be hypertrophy of the thymus, enlargement of the tracheobronchial lymph-glands, aneurism of the aorta, or new growths or cysts arising in one of the mediastinal structures.

If, however, these pressure symptoms are present, and at the same time a tumor can be palpated in the neck just above the sternal notch or clavicle, and if above all it increases suddenly on coughing or moves with swallowing, then the diagnosis of an intrathoracic goitre should be made. If the symptoms have developed very slowly and if the tumor is soft and fluctuating, then a cyst of such an intrathoracic goitre should be present.

In the case reported by Dittrich no tumor appeared in the neck, and during life the diagnosis was not made.

Hypertrophy of the thymus occurs during the earlier years of life. In enlargement of the tracheobronchial lymph-glands there are usually other glands to be felt in the neck. Aneurisms of the aorta give usually expansive pulsation, a thrill, and a double murmur. They may push out the wall of the chest and be seen and felt to pulsate. In absence of physical signs the shadow cast by the X-ray may be of service.

Malignant growths, whether they spring from the lymph-glands, mediastinal tissue, or thyroid gland abnormally placed, all cause by their rapid growth a correspondingly rapid evolution of the symptoms related, in marked contrast to the slow unfolding of the symptoms of a cyst. With *ecchinococcus* cysts and dermoid cysts, in the absence of a palpable tumor, the differentiation would be impossible. Dermoids which have ruptured into a bronchus have been diagnosed by the coughing up of hair, and attacks of urticaria might make one think of an *ecchinococcus* cyst.¹⁶

The sudden appearance of a swelling in the neck after coughing, the softness of the tumor, and the attacks of dyspnoea might lead to the diagnosis of an *aërocele*, that is hernia of the mucosa of the trachea. But *aërocele* should give the physical signs of a tumor filled with air, not watery fluid, nor should there be present the signs of a mediastinal tumor causing pressure.¹⁷

Treatment.—No attempt has been made in any of these large cysts to remove the cyst wall of the intrathoracic portion. Such an attempt would be hazardous.

Yet in the case reported by Dittrich, although the cyst was

so extensive, at autopsy it was found adherent only to the chest wall at one point.

The cyst has usually been opened, the cyst wall sutured to the margin of the skin wound and drained. The cysts have not refilled after this simple treatment, the sinuses closing within two or three months.

In 1901 Kocher¹¹ reported twenty-two cases of intrathoracic goitre in which the goitre had been enucleated. He had had no fatalities. They were enucleated or, where this was impossible, removed piecemeal by the finger working inside the capsule of the gland, thus opening cysts or even abscesses. He does not speak of large single intrathoracic cysts.

REFERENCES.

- ¹ Bonnet: Mémoire sur les goîtres qui compriment et déforment la trachea, *Gazette méd. de Paris*, vol. vi, p. 772, 1851.
- ² Malard: Sur le goître plongeant ou retrosternal, Thèse de Paris, 1879.
- ³ Wührmann: Die Struma intrathoracica, *Deutsch. Zeitsch. f. Chir.*, vol. xliii, p. 1, 1896.
- ⁴ Bowlby: A Case of Large Intrathoracic Cystic Goitre Causing Dyspnoea, *Transactions of the Clinical Society of London*, vol. xxviii, p. 197, 1895.
- ⁵ Boutaresco: Goitre Cystique, suffocant retrosternal opéré avec succès, *Congrès franc. de Chir.*, IV session, p. 335, 1889.
- ⁶ Demme: Beiträge zur Kenntniss der Tracheostenosis per compressionem, *Würzburger med. Zeitschrift*, vol. ii, p. 420, 1861.
- ⁷ Proust: Revue clinique chirurgicale, *Archives générales de Médecine*, vol. ii, p. 233, 1875.
- ⁸ Dittrich: Intrathorac. tumor beding und durch eine struma cyste, *Prog. med. Wochensch.*, vol. xii, p. 262, 1887.
- ⁹ Wölfler: Zur anatomie und Path. des Kropfes und Nebenkoopfes, *Arch. f. klin. Chir.*, vol. xl, p. 169, 1890.
- ¹⁰ Henle: *Handbuch der Systemat. Anatomie des Menschen*, ii, 560, 1873.
- ¹¹ T. Kocher: Kropf excision bei struma intrathoracica, *Verhandlungen der Deutschen Gesellschaft für Chirurgie*, vol. xxx, p. 347, 1901.
- ¹² A. Kocher: Diseases of the Thyroid Gland, *Keen's Surgery*, vol. iii, p. 362, 1910.
- ¹³ Léon Bérard: Corps Thyroïde, *Nouveau Traité de Chirurgie*, vol. xx, p. 335, 1908.
- ¹⁴ O. Wild: Die untersuchung der Luft röhre und die Verwendung der Tracheoskopie bei struma, *Beiträge zur klinischen Chirurgie*, vol. xlv, p. 1, 1905.
- ¹⁵ C. Pfeiffer: Die darstellung der trachea im Röntgenbild, besonders bei struma, *Beiträge zur klinischen Chirurgie*, vol. xlv, p. 716, 1905.
- ¹⁶ De Quervain: *Spezielle Chir. Diagnostik*, vol. xx, p. 160, 1907.
- ¹⁷ Petit: Des tumeurs gazeuses des cou., *Revue de Chir.*, vol. ix, p. 97, 1889.

FURTHER EXPERIENCES WITH ANÆSTHESIA BY THE INTRATRACHEAL INSUFFLATION OF AIR AND ETHER.

BY CHARLES A. ELSBERG, M.D.,

OF NEW YORK,

Surgeon to the Neurological Institute; Associate Surgeon, Mt. Sinai Hospital.

IN previous papers I have reported upon the technic of insufflation anæsthesia, and have described a simple and easily portable apparatus for intratracheal insufflation in man. As it is important to fully understand this new method of anæsthesia, whose great value for intrathoracic surgery is undoubted, I deem it of importance to report upon the additional experiences we have had with the method from the stand-point of the anæsthesia, and to leave to a later publication the experiences that I have had with the method in operations upon the thorax.

Up to the present time, we have anæsthetized almost 100 patients by the insufflation of air and ether, and we have made some observations which shall be briefly reported in what follows.

REGARDING THE TECHNIC OF INTRATRACHEAL INSUFFLATION.

The following remarks are supplementary to the detailed description of the technic given in the *ANNALS OF SURGERY* for February, 1911.

It is always advisable to anæsthetize the patient in the ordinary way by inhalation, before the intratracheal tube is introduced, because it is unpleasant for the patient to have the tube inserted into the trachea while he is conscious. Besides, the beginning of insufflation of the air and ether mixture while the patient is conscious is almost certain to cause a good deal of spasmodic coughing. It is also advisable to give the patient a small hypodermic injection of morphine before the operation, so as to diminish the reflex irritability of the larynx.

In the majority of adult patients a catheter No. 24 French is of the proper size, and exact estimations to determine the best size of catheter to be selected (as described in my previous paper) are unnecessary.

The animal experiments of Meltzer and Auer, and our own, have demonstrated that the anæsthesia is without danger in dogs. Every experimenter knows how easy it is to kill a dog with ether given by inhalation. When the ether is given by intratracheal insufflation, however, it is impossible to kill the animal, and the animals can be kept under the effects of the anæsthetic for many hours without danger. Our experiences in the human being have also been very satisfactory; we have found that the patients stand the anæsthetic remarkably well. They are never too deeply under the anæsthetic; in no instance did we observe a dilatation of the pupils as an evidence of too deep an anæsthesia. From our experience thus far, it seems that it is impossible to give a patient too much ether by insufflation by means of our apparatus. If the full amount of ether possible is insufflated, it means that more ether escapes by the side of the intratracheal tube and out of the larynx and mouth. Complete relaxation is usually obtained with 50 to 75 per cent. of ether (according to the scale). The anæsthetizer must, however, be on the lookout that the patient does not begin to react unless full ether is used all of the time.

We have found that the patient who is beginning to react can very quickly be brought under full anæsthesia again by turning on full ether (100 per cent. of the scale) and by raising the pressure to 40 mm. of mercury for a few moments. In other words, if, during the course of an operation, the patient begins to react, the anæsthetizer should turn the ether indicator to 100 per cent. and raise the pressure (as indicated by the manometer) to 40 mm. (by partially closing the outflow stopcock).

In a similar manner, if one wants to awaken the patient more quickly, one should turn the indicator to zero so that all ether is excluded, and raise the pressure to 30 to 40 mm. of

mercury. For ordinary insufflation anæsthesia, the pressure should not be over 20 mm. In the course of an intrathoracic operation, the pressure of the air and ether mixture, given when the chest cavity is open, must depend upon the amount of distention of the lung that is desired, and can be controlled by instructions from the operator. Under ordinary circumstances, a pressure of 20 mm. will suffice to keep the lung moderately distended.

Up to the present time we have anæsthetized close on to 100 patients by means of intratracheal insufflation. Operations of the most varied kind were performed on different parts of the body. We have not seen a single untoward symptom during or after the anæsthesia. During the anæsthesia, the color of the patient remains pink, the breathing is slow and very superficial, the pulse is slightly accelerated. The rate of the pulse can often be controlled by the anæsthetizer, if the cardiac oscillations of the mercury column in the manometer are marked. In about half of the patients, it has been possible to cause apnoea by raising the pressure to 40 mm. For practical purposes this is, however, unnecessary.

We have had one patient in whom complete anæsthesia could not be obtained by the insufflation.

A young girl upon whom an interval appendicectomy was to be performed, was anæsthetized with ether in the ordinary way, and the intratracheal tube introduced. Insufflation was then begun. In spite of careful manipulations, it was found that it was impossible to cause sufficient relaxation of the abdominal muscles to permit of the necessary intra-abdominal manipulations. The intratracheal tube was then removed, and the attempt made to cause complete relaxation by ether given by inhalation. This also failed, and complete relaxation was only obtained when chloroform was given.

This patient was evidently refractory to ether, although it may have been that the intratracheal tube was too small, and therefore too much ether escaped by the side of the trachea. Careful experimental investigations will have to show whether chloroform can be safely given by intratracheal insufflation.

In a number of instances, operations which lasted two or more hours were performed under ether insufflation anæsthesia. We have gained the impression that the patients are less apt to show symptoms of shock than those anæsthetized for long operations by ether inhalation, but our experience is still too small to allow of any definite statement in this regard.¹

Vomiting is certainly rare after ether anæsthesia by intratracheal insufflation, and we have never seen any patient vomit during the course of the anæsthesia.

We have never seen any unpleasant after-effect from the anæsthesia. None of the patients were hoarse or complained of laryngeal symptoms after the anæsthesia, nor did we thus far observe any pulmonary symptoms in our patients. We have been surprised and gratified to find that the larynx and trachea are very tolerant of the intratracheal tube, and that, after the anæsthesia, the patients had no symptoms which could be referred to the presence, for a considerable period of time, of a tube in their larynx and trachea.

THE VALUE OF THE METHOD OF ANÆSTHESIA IN OTHER THAN THORACIC OPERATIONS.

As already mentioned, we shall report upon our experience with intratracheal insufflation in thoracic operations in the near future. We have, however, found that insufflation anæsthesia is valuable for many other operations.

The anæsthesia is very useful in operations upon the neck, such as thyroidectomy. In the first place, the anæsthetizer is away from the field of operation. More important, the operator can manipulate the trachea as much as necessary without causing disturbance in breathing or interference with the anæsthesia. Nor need he fear a sudden collapse of the trachea in the course of the removal of a large goitre; the presence of the tube in the trachea will guard against such complications.

¹Dr. C. H. Frazier suggested to me that this might be due to the retention of a small amount of CO₂ in the blood, and thus might be in accord with Yandell Henderson's theory of shock.

Insufflation anæsthesia should be very valuable in the operation of laryngectomy, but we have not yet had the occasion to perform a laryngectomy under insufflation anæsthesia.

The method of anæsthesia is of great value in operations upon the tongue and mouth and in operations upon the superior and inferior maxilla where the buccal cavity or pharynx has to be widely opened. There is no danger of aspiration of blood into the lungs, tamponade of the larynx is unnecessary. No blood can run down into the trachea. The current of air which is continually flowing upwards in the trachea by the side of the tube will blow out all of the blood which tends to run down into the larynx and trachea.

The anæsthesia should be useful in those operations in which the patient has to be placed flat on the abdomen. Thus it should be advantageous in those operations upon the brain and spinal cord, such as bilateral suboccipital craniotomy and laminectomy, in which the patient has to be in the prone position and in which the giving of the anæsthesia is ordinarily difficult.

LAMINECTOMY FOR INJURY AND TUMOR OF THE SPINAL CORD.*

WITH A REPORT OF SIX CASES.

BY GEORGE P. MULLER, M.D.,

OF PHILADELPHIA,

Associate in Surgery in the University of Pennsylvania; Surgeon to St. Agnes Hospital;
Assistant Surgeon to the University and Philadelphia Hospitals.

PROGRESS in the surgical treatment of injury and disease of the spinal cord seems to make haste slowly and to be the subject of considerable argument and disagreement among those whom we may consider as authorities. At one extreme is the opinion recently given by Estes:¹ "Early operation offers the only chance for life in a case of complete transverse lesion high up in the cord; it may not only preserve life, but also in a few cases restore some degree of usefulness to paralyzed parts when the lesion is from the middorsal region downwards." On the other hand Spiller and Allen believe that a study of spinal cords removed in cases of fracture will induce a very skeptical attitude and doubt as to whether operation is of much advantage and as to whether the chances would not be greater for the patient without it. They believe that the only effect secondary degenerations could possibly have, would be to *prevent* recovery. They do not believe that hemorrhages or oedema are imperative causes for operation. Starr, however, believes that, "if the cord is only partially injured, an operation may do good when it is evident that the symptoms are kept up by a permanent compression." But he believes that, in the majority of cases, it is necessary to refuse operation because without evidence of pressure an operation can have no result, as the nervous symptoms are due to actual permanent destruction of spinal cord tissues *incapable of repair*. Murphy also states that, "in fractures with

* Read before the Philadelphia Academy of Surgery, February 6, 1911.

¹ Amer. Jour. Surg., 1910, vol. xxiv, p. 341.

division of the true cord, operation with suture of the cord is absolutely worthless, as functional regeneration of the column of gray matter never takes place."

All theoretical reasoning, all experimental evidences, however, seem to be set at naught by the reported instances of recovery of more or less power after complete severance of the cord, in Harte and Stewart's celebrated case, in those of Fowler, Briggs, and Sherris, and in two others recently reported by Estes. Also in the cases of perforation by bullet reported by Pilcher, Pegram, and Haynes.

In the first case reported by Estes he made "a complete section of a disintegrated cord, at the first lumbar vertebra, removed about three-quarters of an inch of the cord, squared the ends, and brought them together with sutures. The man was considerably improved as regards trophic and sensory disturbances, but never regained the use of his lower limbs."

In the second case he resected more than half the thickness of the cord in the lower dorsal region at the level of the ninth and tenth dorsal, leaving the anterior column only intact, and drew the ends of the lateral and posterior columns together by suture. Sensory and trophic paralysis improved almost immediately. The patient finally recovered the use of the left lower extremity, the use of the flexors of the right extremity, and almost entirely the use of the sphincters. By the aid of a brace he can walk with comparative ease.

Such evidence is, of course, impossible to refute, but taking all the evidence bearing upon cord suture, it seems highly improbable that such a procedure can be of any value. Operations for conditions depending simply upon compression of the cord, however, seem to offer sufficient encouragement to warrant operative interference in practically all cases.

Another phase of spinal cord injury is equally as interesting, namely, concussion, a term accepted by some and rejected by others. Stacks of literature have been written about it, and many an expert witness has been paid a fee for testifying to its existence, but "to the impartial observer the conviction must be inevitable that the weight of evidence is against the

existence of the condition" (Bailey). Many of the statements in favor of the state of concussion have been derived from the finding by the surgeon at operation of an apparently normal cord, but we now know that tremendous damage may be done to the cord, the white and gray matter being shaken up together and indistinguishable, or one driven like a wedge into the other, and yet no visible external change is discernible. The comparison with a numbed and tingling nerve or with concussion of the brain is not a true one, as the surroundings of the cord are entirely different and the symptoms of its injury never transitory.

With this brief and fragmentary introduction I wish to report the following cases. I will greatly abridge the histories:

CASE I.—A man, aged twenty-five, was hit by a locomotive engine on July 4, 1910. He was picked up unconscious, and was sent to the Chester County Hospital. In a few hours he regained consciousness, and it was noted that there was complete sensory and motor paralysis below the tenth dorsal segment. The sphincters were paralyzed, but priapism was absent. As no improvement was noted in 48 hours, the attending surgeon, Dr. Woodward, asked me to assist in the performance of laminectomy. I found the conditions as described and a depression in the back over the tenth dorsal vertebra. We were afraid to attempt to elicit crepitus. There were no tests for heat and cold sensation made. The reflexes were absent.

Laminectomy was performed on July 6, 1910, under ether anæsthesia. I found the posterior spinous process of the tenth dorsal vertebra fractured at its base, and the laminae of the same vertebra also fractured and the fragments driven in to the neural canal. They were removed and some hemorrhage encountered external to the dura, which membrane seemed oedematous and thickened.

The posterior portion of the ninth vertebra was next removed and the dura opened. The spinal fluid was under tension, and the cord appeared congested at the site of injury, but no other abnormality was noted. There was no hemorrhachis. The dura was sutured with fine chromic catgut, the muscles and

fascia with chromic catgut, and the skin with silk. A small cigarette drain was placed between the muscles and removed in 48 hours. Two days after the operation sensation began to improve and four days after operation motion began to appear. On the fifth day control of the bladder was regained. A bed-sore developed at the end of the first week and gave considerable trouble owing to the fear of infecting the wound. He was sent to the County House at Embryville in the fall and I saw him on December 7, 1910. He had perfect restoration of sensation as far as I could determine, could walk with ease although a little stiffly, could rise from a chair without using the hands, and had perfect sphincteric control. His back was strong, and he would not wear the brace we had procured.

CASE II.—A man, aged thirty, was injured in December, 1909, by a large rock falling on his back. He experienced loss of motion and sensation in the lower limbs and loss of sphincteric control. He remained in a hospital three weeks and at his home seven months without improvement. He was admitted to Dr. Frazier's service in the University Hospital, August 6, 1910.

On August 10, 1910, the patient was examined by Dr. McConnell, who reported as follows: "The patient shows a complete paralysis of both lower extremities, no movement being made by either the thigh or leg muscles. There is very marked toe-drop, with contracture of the flexor tendon and tendo achillis. The palsy of the thigh muscles is flaccid with contraction of the extensors. All reflex in the lower extremities is lost. There is very marked atrophy, relatively more in the thighs than in the legs. He has complete loss of sensation for touch and pain in both legs up to the head of the tibia on the inner side of the leg and in the thighs corresponding very closely to a line drawn from the great trochanter to the inner side of the knee and from here to the pubic spine. This leaves an irregular triangular area in which sensation to touch and pain is preserved. The posterior surface of the thigh between these two lines shows analgesia and anæsthesia, which extend over both buttocks as high as a line drawn from one great trochanter to the other. This area of analgesia and anæsthesia involves the scrotum and the perineum, also the penis. The cremasteric reflex is present on both sides."

Laminectomy, August 15, 1910, under gas-ether anæsthesia.

A longitudinal incision was made over the last thoracic and the first three lumbar vertebræ. The first lumbar vertebra was distorted and evidently the seat of an old fracture. It projected into the neural canal. The posterior portions of the first and second lumbar vertebræ were removed, the dura was opened, and a cystic condition found about the cord extending about one and one-half inches in length and immediately under the first vertebra. The dura was adherent to the vertebra and the cord adherent to the dura. After loosening the intraneural adhesions, the spinal fluid began to flow freely from the upper portion of the canal. The cord seemed to be intact, but was grayish in color, rather hard at its lowest portion, and the roots of the cauda equina were adherent. Several of the roots were freed from adhesions to each (combed out) but this was not extensively undertaken, as it was feared that they might be torn in the process. The dura was then sutured with a continuous catgut suture and the muscle closed with chromic catgut. A small rubber tube was inserted between the edges of the closed muscles and brought out on the back through a separate stab wound. The skin was closed with silk.

Forty-eight hours later the drainage was removed, and at the end of a week the stitches were taken out of the skin; the wound had healed by first intention. Seven days after the operation the patient's condition seemed improved, there was no return of motor power, but the area of sensation had widened. At the end of the second week the patient claimed that sensation had returned in a very slight degree over most of the foot and leg. He was discharged from the hospital two weeks later in the same condition.

If there is such a thing as concussion of the cord, then my first case represents such a condition, and perhaps the man would have recovered just as well without the operation. If such does not exist, a simple contusion or the results of œdema were responsible for the paraplegia, and the removal of the compressing bone must have helped in the recovery. In the second case, immediate operation was not performed, the arch of the vertebra continued to press on the cord, and who knows but what the hopeless result was caused or exaggerated

by the organization of a cellular infiltrate caused by the compressing bone? The neurologists who refer to the injury to the cord as having been done in the twinkling of an eye, and as beyond regeneration or help from the surgeon, speak from the experience of the fatal cases. The literature contains many instances of more or less complete recovery after operation, especially those cases in which the compression is caused by fragments which have been driven forward into the neural canal.

A few years ago C. E. Black reported a collection of 552 cases taken from the literature. Of the cases operated on, 49.2 per cent. recovered and 40 per cent. died; of those not operated on, 25 per cent. recovered and 65 per cent. died. The fracture cases gave the following figures: the mortality of operation in the cervical region was 71 per cent., without operation, 85 per cent.; in the dorsal region 48 per cent., without operation, 64 per cent.; in the lumbar region, 26 per cent., without, 50 per cent. Many of these cases are old and before the technic of aseptic surgery reached its present perfection.

Even as long ago as 1898 Prewit tabulated 49 cases of gunshot wounds of the spine treated since the aseptic era. Of this number 24 were operated on with 13 deaths, and 25 were not operated on with 17 deaths. Haynes collected the cases of gunshot injury from the date of Prewit's paper up to 1906 and found a mortality of 42.5 per cent. in the operated cases and 69.25 per cent. in those not operated on.

I believe that Bailey finds the true solution when he states that "somewhere between the two extreme positions the wisest course lies." In fractures and dislocations of the cervical and high dorsal regions operation should rarely be undertaken, unless there is evidence to show that comminution of the bones has occurred. The X-ray should be employed, as palpation for crepitus is too dangerous. In the lower dorsal, and especially in the dorsolumbar region, early operation offers a better chance for the restoration of function than the expectant plan. The mortality of laminectomy at the

present time should be less than 10 per cent. in fractures below the middorsal region.

It may be of interest to recall that Steinmann has recently collected 20 cases of forcible reduction of cervical dislocations without laminectomy, with 12 recoveries.

Tumors of the Cord.—Some 20 years ago the first successful extirpation of a spinal cord tumor was performed by Horsley.

In 1895 Starr analyzed 123 cases of spinal cord tumor, in 22 of which laminectomy was performed, with 50 per cent. mortality and 6 recoveries. In 1902 Collins collected 70 cases recorded since Starr's paper, with 30 operations and 12 successful results. In 1907 Oppenheim states that recovery takes place in about 50 per cent. of the cases presenting a typical clinical picture of extramedullary growth. Last year Bailey reported 6 cases in which extirpation was attempted, with 3 recoveries, 1 doubtful case and 1 death; Hunt and Woolsey record 11 laminectomies with 1 operative death and 4 successful cases out of 6 where the growth was extramedullary. In 1909 Oppenheim reported that he had obtained cures in 13 out of 25 patients with tumors in the spinal canal.

As soon as the diagnosis of tumor can be made with reasonable certainty an operation is indicated. I am not sure but that if I had symptoms even *suggestive* of spinal cord tumor I would have an exploratory laminectomy performed. In a case reported recently by Inglis, Klingman, and Ballin, an extramedullary glioma was removed quite early from a patient whose only symptom was sharp, circumscribed pain in the area supplied by the seventh thoracic nerve. A complete recovery resulted. Another interesting case with a fine result is reported by Moffitt and Sherman. It is generally impossible to differentiate positively between the intramedullary and extramedullary growths clinically, as pain may be absent and dissociated anæsthesia present in extramedullary growths; the patient should be given the benefit of the doubt. Bailey believes that the absence of anæsthesia contraindicates operation. The operation is supposed to be hazardous, and

the statistics of Krause are now being quoted in support of this statement. He operated on 26 patients with 8 deaths. But if we compare Hunt and Woolsey's cases with only 10 per cent. mortality, the results seem better. Elsberg believes that operations for tumors of the spinal cord in the cervical region should be done in two stages, a small incision being made in the dura at the first operation through which the growth will extrude, thereby making it more easy of removal at a second operation.

CASE III.—A woman, aged fifty-six, was admitted to the University Hospital August 18, 1910, complaining of weakness in the right hand and right leg. She was referred to me by Dr. D. J. McCarthy, and a more detailed report of the case will be made later.

More than two years ago the patient began to drag the lower limb, and shortly afterwards to weaken in the right upper limb. After a period of rest and treatment, the weakness of the right upper and lower limbs seemed to entirely disappear. In August, 1909, the condition returned and had been gradually increasing until the present time. In January, 1910, severe shooting pain was experienced, shooting from the right shoulder into the finger, which would feel as if drawn at times and the hand was numb. The right hand and arm were slightly swollen and cyanotic and extremely weak.

All of the movements of the right arm were weak and the shoulder motion much impaired. Passive motion was painful. The right lower limb was also weak, especially of the ankle and toes, where the power was slight. Patella reflex was prompt and exaggerated on the right side, but absent on the left. Clonus absent, Babinski typical on the right and uncertain on the left. The patient recognized the movements of the toes upwards and downwards on either side but made mistakes in locating the toe on either the right or left foot.

The sensation of heat and cold was normal in the right lower limb, in the right upper limb, and also in the left upper limb, with the exception that heat and cold were perceived more distinctly in the right hand. Ice water was felt as warmth in the entire left lower limb and left side of trunk, back and front,

as far as about the third interspace. Pin prick was normal in the right upper and lower limbs, was greatly impaired in left side of trunk, back and front, as high as the third interspace. Pin prick was not so acute in left hand as in the right. Tactile sensation was about normal everywhere.

Laminectomy, August 22, 1910, under gas-ether anæsthesia. The incision was made over the fourth, fifth, and sixth cervical vertebræ to the bony surfaces of the posterior spines. After cleaning off the muscles the laminæ of the fifth vertebra were removed and the dura exposed. The bones were extremely thin. The dura appeared normal, but pulsation was extremely faint. It was opened and the cord found normal in appearance and free from adhesions. Upon insinuating the Horsley separator upwards, a mass was felt just above the opening. Accordingly, the fourth and fifth spines were removed and the laminæ of the fourth vertebra rongeuired away. After opening the dura still further, a tumor was found on the anterolateral aspect of the cord, oval in shape, and about 1.5 cm. in diameter. The anterior and posterior roots of the fourth segment were tightly stretched over the tumor, and the roots of the fifth were pushed upon. The cord itself was compressed and deviated to the left. The tumor seemed to grow from the pia arachnoid and not from the dura. The fourth root was gently pulled upwards on a blunt hook, and a slight incision made at the junction of the tumor with the cord, and the growth easily shelled out with the handle of a teaspoon. Comparatively little bleeding was encountered and it was soon checked. The dura, muscles, and skin were closed in the usual manner. Microscopic examination of the tumor revealed the appearance typical of endothelioma. The patient made a good operative recovery, and at the present time, six months' after the operation, is alive and well and rapidly improving as regards function.

The following two cases are reported to complete the series:

CASE IV.—A Chinaman, aged forty, was referred by Dr. McCarthy from his ward in the Philadelphia Hospital to Dr. Frazier's service, with symptoms of compression of the cord referable to the twelfth dorsal and first lumbar regions. August 14, 1908, I performed a laminectomy of the first, second, and

third lumbar vertebræ and found no tumor. September 4, 1908, I again operated and removed the eleventh and twelfth dorsal laminæ, and between these there was considerable connective tissue, dense in consistency, and seeming to press upon or constrict the cord. It seemed to take origin from the intervertebral disc but was not cartilaginous. It was cut away with scissors and the wound closed. The patient recovered control of the bladder, and somewhat of sensation after operation, but never recovered the power to move the legs. He died in the Philadelphia Hospital one year later. Microscopic examination of the tissue removed showed no evidence of neoplasms, tuberculosis, nor syphilis.

CASE V.—A colored man, aged forty-five, also referred from Dr. McCarthy's ward in the Philadelphia Hospital to Dr. Frazier's service, had been operated upon previously in another hospital and his prostate removed. It was said to have been carcinomatous. He was suffering from a paraplegia and intense pain due to compression of the lower portion of the cord and roots. I performed laminectomy, September, 1908, at the Philadelphia Hospital, and found much softening and disease of the third and fourth lumbar vertebræ, but was not able exactly to ascertain whether there was pressure on the cord or not. The muscles and the bones bled considerably during the operation, and twenty-four hours later the patient died from shock.

Cysts.—Circumscribed spinal serous meningitis as a distinct disease has been recognized since 1903, and a number of cases have been reported since then. Last November, in association with Dr. T. H. Weisenberg, I reported² a case successfully operated on and discussed the condition. This patient (Case VI) had the laminectomy performed on March 16, 1910, at which time a cyst was found at the level of the tenth dorsal vertebra. At the present time the patient has entirely recovered from the symptoms of compression, is able to work as a stenographer, and to attend dances. At the end of the day her back often feels tired and often aches, but relief is afforded by adhesive plaster stripping.

² Amer. Jour. Med. Sciences, November, 1910.

ORGANOSCOPY.

CYSTOSCOPY OF THE ABDOMINAL CAVITY.

BY BERTRAM M. BERNHEIM, M.D.,

OF BALTIMORE, MD.,

Assistant in Surgery, The Johns Hopkins University.

(From the Hunterian Laboratory of Experimental Medicine, The Johns Hopkins University.)

IN October, 1910, Jacobaeus, of Stockholm, published a brief note in the *Münchener medizinische Wochenschrift* concerning the possibility of cystoscopic investigation of the serous cavities.¹ According to his plan the abdominal cavity is punctured with a trocar, corresponding in size to a No. 17 Charriere catheter. Through this tube, which has a trap-door, filtered air is first pumped into the peritoneal cavity and then a Nitze cystoscope, corresponding in size to a No. 14 Charriere, is inserted. The cystoscope, too, has a trap-door to keep the air pumped into the peritoneal cavity from escaping.

By this method it was possible to subject to visual examination the abdominal viscera in certain obscure conditions, in which a large incision or one of sufficient size to permit the introduction of the hand was objected to by the patient and not considered desirable by the physician. In other words, Jacobaeus hoped to do for the general abdominal cavity what is now an every-day occurrence as regards the bladder—to diagnose conditions by means of the cystoscope.

After some practice on the cadaver, Jacobaeus made clinical use of this instrument in 17 cases of ascites, the method of procedure having been, first, to draw off the fluid through the trocar and then pump air in before inserting the cystoscope. In one case he diagnosed a metastatic nodule in the

¹ H. C. JACOBÆUS: Ueber die Möglichkeit die Zystoskopie bei Untersuchung seröser Höhlungen anzuwenden, *Münch. med. Woch.*, No. 40, 1910.

liver; in another carcinoma of the stomach; and in still another a general carcinosis of the intestines. He also used the method twice in the pleural cavity, but could make out nothing definite.

Early in 1910 a similar idea had occurred to us, and in April of the same year, we started some experimental work in the Hunterian laboratory to decide as to the feasibility of the idea. Its possible worth soon became apparent, and we have now evolved the following method of procedure:

An ordinary proctoscope of one-half inch bore, the distal end of which is blunted by means of a metal collar, serves as the cystoscope. An electric headlight furnishes illumination. Through an incision made in the epigastrium of sufficient size to accommodate the instrument, the tube is inserted (without obturator) until its blunted end comes down on the anterior wall of the stomach. The normal peritoneal fluid will allow the tube to gently glide from place to place, and first the lesser, then the greater, curvature can be thoroughly inspected. Following this, the gall-bladder can be easily located and viewed, together with the underlying surface of the liver. On withdrawing the tube a little until the distal end is again just over the stomach, its outer end is tilted almost flat on the outer abdominal wall until the parietal peritoneum comes into view. By inserting the tube further in then and sweeping it around, always keeping the parietal peritoneum in view, the abdominal cavity can be inspected with surprising freedom. The omentum naturally precludes a good view of the intestines, unless, as is sometimes possible, one can shove it aside or get under it, but the tube can without difficulty be swept over the whole upper surface of the liver, so that this and the overlying diaphragm can be brought into view. There is always the possibility of encountering adhesions, and it is on this account that the obturator is dispensed with, because when seen they are easily avoided, the involved area being inspected on all sides.

In addition to this, acting on the theory that nothing definite has been found in a given case, we have drawn a part of

the stomach out through the wound, made an incision in its anterior wall, and inserted the cystoscope directly into its cavity. A stomach tube passed in through the mouth acts as a guide in this procedure and aids in a careful inspection of the whole gastric mucosa. On withdrawing the cystoscope, the wound in the stomach is closed in the usual way.

In certain cases of early carcinoma of the stomach, this method of examination may prove of some value. Likewise, the presence of an obscure ulcer may be thus disclosed and submitted to the proper treatment. In cases of ordinary exploratory operation for carcinoma, before having recourse to the usual large incision, the cystoscope introduced through a very small and relatively unimportant incision, possibly made with cocaine, may reveal general metastases or a secondary nodule in the liver, thus rendering further procedures unnecessary and saving the patient a rather prolonged convalescence. In other obscure conditions of the upper abdomen,—possibly the abdomen in general,—the diagnosis might be cleared up by this simple method. Its field of usefulness also might in the future be extended to the thorax, though this is a development which we ourselves have only in mind.

Through the courtesy of Dr. W. S. Halsted, we were first enabled to try our method clinically. The patient was a man who had been deeply jaundiced for some time, and in whose abdomen a markedly distended gall-bladder could be palpated. In the upper right epigastrium the tube was inserted, coming down first upon the omentum. This was shoved aside and by dipping the outer end of the cystoscope on the abdominal wall, the distal end was easily manipulated until it came up against the distended gall-bladder. This was inspected carefully on all sides and down to its neck. There were no adhesions and no abnormalities. Following this, in the manner described above, the parietal peritoneum was brought into view, and then the whole surface of the liver was inspected. No nodules were discovered. The tube was then withdrawn and the incision enlarged for the usual exploratory laparotomy, whereupon a carcinoma of the head of the pancreas was found. The

cystoscope findings as regards the gall-bladder and liver were corroborated; in other words there were no metastases. Obviously, a structure lying as deeply as the pancreas could not be inspected.

In a second case, that of Dr. William A. Fisher, Jr., the cystoscope was brought into use in order to rule out, if possible, the presence of a gastric ulcer. This we succeeded in doing, the case proving to be one of chronic appendicitis.

Though it is hardly possible to decide as to the merits of any procedure by two clinical cases, we feel that the results obtained in these cases were sufficiently encouraging to warrant a further trial.

THE TREATMENT OF CHRONIC PANCREATITIS BY PANCREATOSTOMY.

A NEW OPERATION.

BY GOETHE LINK, M.D.,

OF INDIANAPOLIS, INDIANA.

Assistant Professor of Gynecology in the Indiana University School of Medicine.

THOUGH chronic pancreatitis was recognized post mortem many years ago, it was not found in the living until 1891, when Robson¹ observed the enlarged pancreas while doing a cholecystotomy. His first cases were mistaken for malignancy, but recovery showed the condition in its true light. In 1892 he was able to demonstrate the nature of the enlargement by microscopic examination. The development of surgery of the bile passages has led to much of our present knowledge about pancreatitis, as it is found frequently at operations for gall-stones.

The importance of chronic inflammation of the pancreas as a complication of gall-stone disease has been emphasized by a number of investigators. W. J. Mayo,² in calling attention to pancreatitis resulting from gall-stone disease, reported that he had found the pancreas involved 141 times in 2200 operations on the gall-bladder and biliary passages. Of all pancreatic diseases operated by Mayo, 81 per cent. were "due to or accompanied by gall-stones." Most observations regarding chronic disease of the pancreas have been made by operators interested in liver surgery, and operations have usually not been undertaken until biliary disease, if it were not the cause of the pancreatitis, had become a complication of it. Though it is a well-established fact that disease of the bile passages is the most common cause of pancreatitis, it is also true that the pancreas is sometimes the point of origin of disease, and through its anatomic relation with the common duct produces jaundice and other biliary disorders. It is significant that in Robson's first cases of chronic pancreatitis, jaundice

was present and the operations were made upon a diagnosis of stones in the common duct, but no stones were found. An investigation of a considerable number of cases of chronic pancreatitis, both with and without pancreatic calculi, resulting in death and followed by autopsy, shows that 50 per cent. had never been jaundiced; and in only 15 per cent. was the presence of gall-stones noted. Thus it is seen that while cholecystitis with gall-stones frequently causes chronic pancreatitis, it often arises from causes independent of the biliary system.

At present the treatment of chronic pancreatitis consists in drainage of the gall-bladder, either by cholecystostomy or by cholecystenterostomy. This, no doubt, cures the majority of cases brought to the operating table, as most of them come to operation for gall-bladder disease, the relief of which either removes the cause of the pancreatitis or by some effect on the hepatogastropancreatic system aids a restitution to normal. The mere subverting of the bile stream will sometimes fail to cure a pancreatitis, especially one which has arisen from some cause within the pancreas, and in which jaundice, if present, has been produced late in the progress of the pancreatitis by pressure of the swollen gland upon the common duct. In pancreatitis due to the presence of calculi in the duct of the gland or in its parenchyma, the inadequacy of gall-bladder drainage is evident.

Our knowledge regarding chronic pancreatitis, aside from those cases associated with biliary disturbance, is very meagre. This is due to the fact that the pancreas probably produces fewer and milder symptoms for the same degree of disease than does any other organ in the body. In 1882 Pepper³ wrote: "It is unfortunate to have much to say, and yet to have no intelligible language in which to express it. This is somewhat the lot of the pancreas."

Not until operators come to consider the pancreas a field for successful work, will the confusion that now exists regarding its diseases be dispelled. We must operate just as freely for obscure disease in the upper abdomen probably involving the pancreas as we operated a few years ago for disease prob-

ably involving the gall-bladder or probably involving the appendix. Almost every operation upon the pancreas now recorded was done as a result of undertaking an operation upon some other organ through a mistaken diagnosis. Excepting the drainage of cysts, surgical manipulation of the pancreas is very unusual.

The thorough and convincing experiments of Senn⁴ made in 1886 seem to be forgotten by surgeons of to-day. His experiments were performed on healthy dogs and cats, and the observations he made hold good in the human subject. We have confused the baneful action of pancreatic secretion in acute hemorrhagic pancreatitis accompanied by fat necrosis, with its action at other times. Senn showed that subcutaneous crushing or comminution of the pancreas, followed by an escape of its secretion, is not a fatal or even a dangerous accident, when the gland is otherwise normal.

In a great measure our timidity in dealing with the pancreas is due to erroneous deductions. In 1903 Von Mikulicz-Radecki,⁵ in an article which was generally accepted as the last word in surgery of the pancreas, said: "When we seek the cause of the tardy development of the surgery of the pancreas, we find we can ascribe it principally to three general reasons, which we must consider carefully, as they show us that which we may expect from this branch of surgery in the future." The reasons given by him are as follows: (1) The topographical relations of the organ. (2) The difficulty in diagnosis. (3) The operation, so far as it includes the organ itself, is much more dangerous than an operation upon any other abdominal organ. Hemorrhage is difficult to control. Necrosis is caused by deep sutures. In spite of deep and heavy ligatures *en masse*, blood and pancreatic secretions ooze into the peritoneal cavity, preventing the formation of peritoneal adhesions. Secondary hemorrhage is apt to occur. There is great danger of fat necrosis, due to the special secretion of the gland leaking from the injured parenchyma.

In our own case which we shall shortly report, we undertook the operation in a spirit of desperation, and then quietly

awaited the patient's certain death afterward from some of the causes just given. This probably represents the state of mind in which most surgeons would be found should it suddenly become necessary that an extensive operation be made upon the pancreas.

Though the observations of Von Mikulicz-Radecki were based upon a large number of cases, 60 in all, 30 of them were gastrectomies for cancer, and as the pancreas was involved in the cancerous process, they were counted as cases of pancreatic surgery. It was taken for granted that an increased death-rate after gastrectomy with injury of the pancreas from freeing adhesions was due to the pancreatic involvement. The remaining 30 cases of Von Mikulicz-Radecki included 10 pancreatic cysts, 15 malignant growths, 1 contusion with hæmatoma, 3 cases of pancreatic tumor, and 1 case of chronic pancreatitis. It is possible that observations based upon such cases as are reported by Von Mikulicz-Radecki may not be applicable to chronic pancreatitis. Undoubtedly, certain conditions such as fat necrosis and uncontrollable hemorrhage, present in one pancreatic disease, are not to be found in all pancreatic affections; and while we may have to meet these difficulties, we may learn when to expect them and how to avoid them. Let us hope that in chronic pancreatitis we may prove to have exemption from all the dire results that are said to accompany surgical interference in other pancreatic disorders.

In our limited experience, the chronically inflamed pancreas can be cut, sewed, and worked upon as safely as can any other organ of the body as regards the organ itself. It is true that the topographic relations of the pancreas make it difficult to reach, and that a diagnosis is not easy. In chronic pancreatitis we have not found hemorrhage difficult to control. We have not found necrosis caused by sutures properly placed. We have not been troubled with oozing secretions preventing peritoneal adhesions. We have seen no secondary hemorrhage, no fat necrosis. It may be urged that some change due to the diseased condition has protected our patient from these

operative accidents; this we think true to the extent that in chronic pancreatitis there is a great production of connective tissue. However, as a microscopic examination of the portion of pancreas removed in this case shows the presence of much normal gland structure, we may consider this case open to the accidents peculiar to pancreatic tissue. The presence of connective tissue found in chronic pancreatitis makes the gland much easier to handle than it is in other conditions; it is not so readily torn, stitches hold better. We might expect bleeding after incision to be worse, as it is in other sclerotic organs, the tonsils for example.

I desire to report the following case. It is the first case on record in which pancreatostomy has been performed for chronic pancreatitis and is the seventh case operated for pancreatic stone.

February 14, 1910, I was asked by Dr. W. F. Holman of Clarks Hill, Indiana, to examine a lady, supposed to be suffering from some disease of the stomach, probably malignant. She had been under his care for two months. The patient was twenty-two years old, five feet six inches tall, and weighed 118 pounds. She was emaciated and very anæmic. There was no jaundice, the sclera were clear. Her face was peculiarly marked with curved lines, the concavity of which was opposite the oral cleft on each side—such lines as the older clinicians considered indicative of chronic gastro-intestinal disease.

Family History.—Father living. Mother died of tuberculosis of the bowels at forty-four. Two brothers living, two brothers and two sisters died in infancy, one brother died at twenty-three from obstruction of the bowels.

Past History.—She has had no serious illness, such as typhoid or malaria, never had mumps. As far back as she can remember, from the time she was a little girl at school, she had been frail and has had occasional vomiting spells. She would be free from these attacks for six months or longer, when they would return for a short while. In September, 1909, she had a severe attack, vomiting every few days, losing much weight, and becoming very pale. At that time she was treated by a physician for "stomach trouble." She had attacks of pain

centring on the left side just under the ribs, and was tender there constantly. From September, 1909, until I saw her in February, 1910, she suffered continually. She never had diarrhoea. Her stools had never attracted attention from any peculiarity such as free fat. Any slight exertion, such as sweeping or lifting, would bring on a paroxysm of pain. Pain always started in the left side on a level with the left kidney and slightly toward the median line, then passed around her waist, "making a circle around her," and down the left ureter. A drink of water excited this pain as quickly as the water reached the stomach. She obtained relief best by lying on her back or on the left side. Her favorite position was obtained by placing several chairs together so that she could lie on her back with her feet resting on the top of one of the chairs. Her menstrual function was established at thirteen, and had always been normal except for short periods of amenorrhœa when she was anæmic from her chronic affection.

Examination.—The thoracic organs were found to be normal. The abdomen was symmetrical, and there was no evidence of any muscular restriction on respiration. The lumbar regions were symmetrical. Light palpation elicited no rigidity or heightened cutaneous reflex over any part of the abdomen. Heavy palpation revealed a very tender point accurately defined just under the junction of the left midclavicular line and the confluent costal cartilages. The tenderness subsided as the pylorus was approached; and the liver and gall-bladder were not tender in the least. There was marked tenderness along the course of the left ureter. The appendix was not tender. There was a tender spot to the left of the tenth and eleventh dorsal spines. Bimanual palpation below the left kidney revealed tenderness but no ptosis.

The patient's urine was examined and proved to be free from sugar and albumin, but filled with cells of different kinds, including pus. As she complained of bladder symptoms, I went to her home and catheterized her ureters. In the specimens obtained direct from the kidneys nothing of note was found except red blood-cells, which were attributable to the trauma of passing the ureteral catheters. The Cammidge test was not made.

March 14, 1910, she was brought to the Methodist Hospital

for closer observation. Taking advantage of an attack of her pain, I again catheterized her ureters, but over a period of one-half hour obtained no urine from the left ureter. That led me to suspect an intermittent hydronephrosis. I then passed leaded bougies into the ureters and had radiograms made of both kidneys. The radiograms were poorly made, and it was necessary to repeat the experiment. The second plates were poor also, but seemed to show a variation in the pelvis of the left kidney as indicated by the direction of the shadow cast by the upper portion of the bougie. I measured the capacity of the pelves by injecting them, but found them equal and normal. It was decided to make an exploratory operation, first exposing the left kidney.

Operation.—Drs. Holman and Strickland assisted in the operation. Having catheterized the left ureter that I might know whether or not it was patent throughout by finding the catheter in the pelvis of the kidney, I made a lumbar incision and exposed the left kidney. The ureteral catheter had reached the highest point of the kidney pelvis. The pelvis was normal. The kidney had the appearance of being involved in a surrounding inflammatory process. It was decided that the kidney could not be the cause of the patient's condition, and further exploration through the lumbar incision was begun. Directly in relation with the kidney was a peculiar, pointed object, which felt like a bag of fine sand. It was about the size and shape of a moderately distended gall-bladder. It occupied the anatomic position of the tail of the pancreas, and was recognized as such. The kidney was replaced and the wound closed, a drainage tube being placed as usual after disturbing the kidney.

The patient was turned on her back, and remained on the elevating sand pillow used for exposing the kidney. A vertical incision four inches long was then made above the umbilicus slightly to the left of the median line. The gall-bladder and bile ducts were carefully examined and found to be normal. The stomach was normal. There were no adhesions.

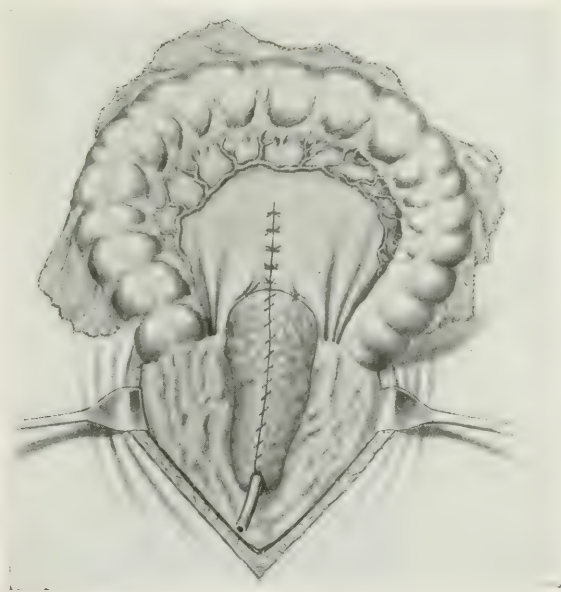
The colon was lifted, and a suitable place being chosen, a rent was made in the mesocolon, which, except for being larger, was like the opening for a gastro-enterostomy. The pancreas was enlarged symmetrically. The head was as large as a man's clenched fist, and the body was the size and shape of a

FIG. 1.



Showing the pancreas brought through the opening in the mesocolon. The stomach is seen just above the pancreas.

FIG. 2.



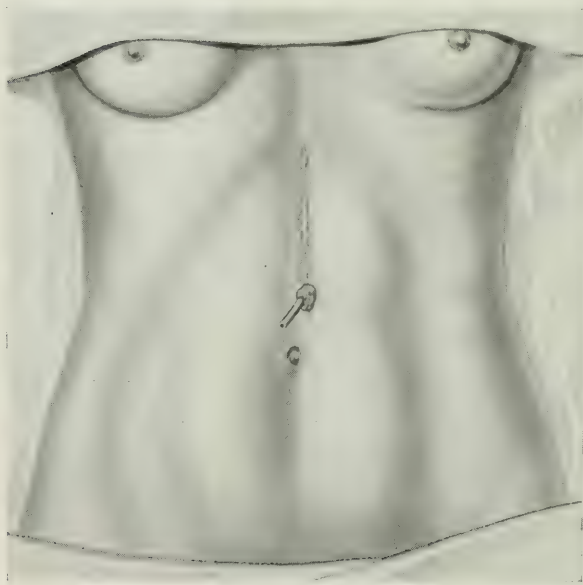
The pancreas is shown with the drainage tube inserted, and the incisions in the pancreas and mesocolon have been closed.

FIG. 3.



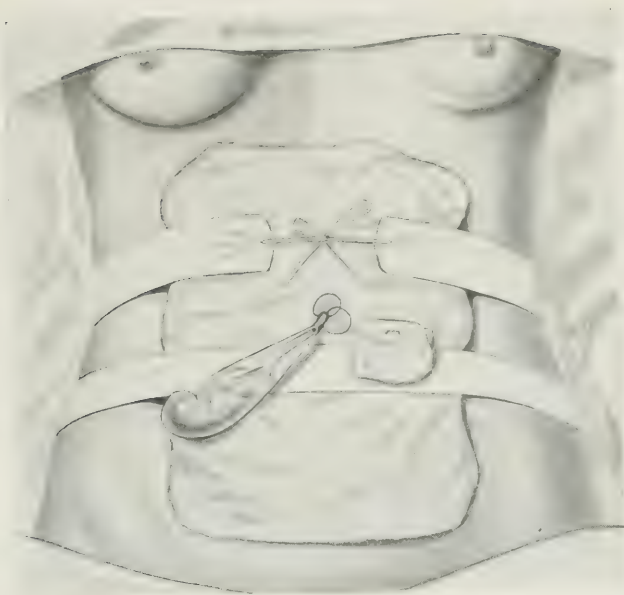
The method of placing the omentum so as to cover the suture line in the pancreas is here shown.

FIG. 4.



The tail of the pancreas with the drainage tube projecting is seen at the lower angle of the healed wound. (Drawn from life.)

FIG. 5.



The method of dressing and collecting the drainage is shown. The drainage sac is carried in the pouch when the patient is standing.

FIG. 6.



Illustrates the pancreas brought through between the colon and stomach instead of through the mesocolon.

FIG. 7.



Microphotograph showing the extreme degree of fibrosis of the pancreas; the disappearance of normal parenchyma, and the relative immunity of the glands of Langerhans from the fibrotic invasion.

man's wrist. It gave the same sensation to the touch over its entire extent as of a bag filled with sand. I decided to explore the main pancreatic duct, and since it was apparent that the stony deposits in the parenchyma could not be removed, to attempt direct drainage. In order to accomplish this successfully, it seemed necessary to have a channel of pancreatic tissue leading out of the abdomen for carrying the gland secretion. Tearing through the posterior wall of the lesser cavity, I seized the tail of the pancreas, and making gentle traction, began to enucleate it just as if it were a pyosalpinx covered with adhesions. It was a comparatively easy task to free the pancreas until the superior mesenteric artery was reached. As this enabled me to bring the tail out of the abdominal cavity easily (Fig. 1), I did not attempt to disturb it further. Sponges were placed in its bed to arrest hemorrhage, which was not at all alarming; the pancreatic branches of the splenic artery were not ligatured. I then split the pancreas in the middle line along about two-thirds of its length, after having protected the operative field with sponges. This opened the dilated duct of Wirsung, which was found to be filled with small faceted stones along its entire length. The stones, excepting those in the head of the gland, were removed. A small portion was excised from the middle of the gland for microscopic study.

A drainage tube made from a portion of a 16 F. red, soft rubber catheter was laid in the duct of Wirsung and allowed to extend beyond the tail of the pancreas for several inches. The gland was then closed around it carefully with a continuous suture of No. 1 chromic catgut (Fig. 2). Each suture included a fair amount of gland tissue. No effort was made to close the edges of the duct separately. No deep buried stitches were placed in the pancreas. In sewing the gland, care was exercised to have the continuity of the outer surface accurate; points of imperfect coaptation were reinforced by single stitches. In places where the duct was not large enough to include the drainage tube, the gland substance was united over the tube.

The opening in the mesocolon was carefully closed and stitched to the pancreas to prevent hernia into the lesser peritoneal cavity. The great omentum was used to cover the suture line in the pancreas above, being folded under the colon parallel with the mesocolon (Fig. 3). A gauze drain was placed below

the pancreas to separate it from the small intestines; this drain was brought out of the wound. The abdominal wound was then closed. The pancreas was brought out of the lower angle of the incision and was stitched to the deep muscular aponeurosis to keep it from withdrawing into the abdomen before becoming adherent. There projected at least one-half inch of pancreas beyond the skin, and out of the summit of the pancreatic tissue the drainage tube extended (Fig. 4). An ordinary rubber condom was tied over the end of the drainage tube.

Before the operation the patient's pulse ranged from 54 to 80; usually it was below 60, seemingly as a result of her disease. Her temperature was never above 99°. Immediately after the operation, the patient's pulse was 120. Within 48 hours it had gradually dropped to 76. The highest post-operative temperature was 100°. The temperature reached normal at the end of three days.

Pancreatic fluid began to flow from the drainage tube at once. This was collected and measured. The largest amount passed in 24 hours was 25 ounces and 6 drachms. The usual amount for the first two weeks was 24 ounces in 24 hours. After two weeks, this amount had become reduced to 18 ounces. At the end of the third week it was 6 ounces in 24 hours. This decrease was not due to a decrease in the secretion, but to the fact that as the pancreatitis subsided and the swelling of the gland became reduced, a greater portion was allowed to escape by the normal way. At the present time, drainage is from 2 to 8 ounces in 24 hours, according to circumstances. The tube was protruded through a cotton-filled pad, and no fluid reached the skin; except once or twice when a poorly tied tape allowed escape of fluid from the container, the skin has not been excoriated. This method of collecting the fluid in a condom (Fig. 5) is excellent to prevent soiling the skin. It was originated by Dr. G. J. Cook of Indianapolis for collecting bile after cholecystostomy. The patient, who is a very intelligent lady, lives 200 miles away in a neighboring State, and cares for the drainage herself.

Within three months after the operation she had gained 20 pounds; at the present time she weighs 148 pounds. Her old attacks have never recurred. She is able to ride horseback and to enjoy all the pleasures of life. She states that her

health is better than at any time for several years. By an artful arrangement of her clothing, and by having the drainage tube very short, she dresses and mingles socially among those who know nothing of her affection.

Pathological report by Dr. Jewett V. Reed:

Examination of Gross Specimen.—This consisted of a small wedge of pancreatic tissue, somewhat firmer in consistency than normal, and showing beneath the capsule of the gland numerous, fine, hard, white bodies about .5 mm. in diameter. Upon cutting the membrane over these bodies, they were easily removed and were found to be calcareous deposits. Over the cut surface of the specimen the finer ducts of the gland were considerably dilated, and contained numerous fine calculi which could be easily removed with a needle. The specimen was hardened in formaldehyde and divided into two portions, one of these was put through a process of decalcification in order to remove the calculi, the other was simply imbedded after hardening. Both of these were sectioned and stained with hæmatoxylin and eosin. Sections from the decalcified section showed practically the same changes as in the one untreated by this process but less distinct on account of the action of the acid.

The following microscopic report was taken from the specimen which had not been subjected to the decalcifying process. On cutting the sections from this block of tissue, many exceedingly fine, hard granules were encountered by the edge of the knife.

Microscopic Examination.—Under the low power the sections show a great preponderance of connective tissue over the parenchyma. This connective tissue has all the appearance of scar tissue in different stages of development. In some regions it is composed of old connective tissue with very few cells. In other regions, numerous blood-vessels and young connective-tissue cells are present. The greater part of this connective tissue is interlobular. Within this connective tissue dilated acini are seen, which are, in the main, devoid of mucous membrane lining, and about which there is a fairly active but chronic type of inflammation. In a small area of the section the connective tissue is distinctly intralobular. It shows a fairly active though chronic type of inflammation, and is associated with a somewhat dilated acinus, which, however, still contains a mucous membrane lining.

The true parenchyma of the gland is in the greater part arranged in definite lobules, and is practically normal in appearance, except in those few areas where there is an intralobular cirrhosis. A few islands of Langerhans, practically normal in appearance, are seen within the sections. Some of these lie within the secreting lobule, and others are isolated and lie within the connective-tissue overgrowth.

The general appearance of this specimen shows that it consists of multiple calculi of the pancreas lying in the finest acini of the gland and extending to the larger ducts. There is no evidence that these lie in or adjacent to the true secreting cells of the pancreas. Those calculi that

lie just beneath the capsule of the gland probably reached this position by producing a pressure necrosis of the overlying parenchyma.

Pathological Diagnosis.—Multiple calculi of the pancreatic ducts associated with a marked degree of chronic interstitial pancreatitis, chiefly of the interlobular type. It is impossible to state which of these two conditions (calculi or interstitial pancreatitis) is the primary condition.

I desire to point out certain facts based upon this case and a study of a number of cases of chronic pancreatitis due to calculus, in the literature. The state of emaciation in which the patient was presented is always found in chronic pancreatitis of long duration. In our opinion this is due, not so much to the absence of pancreatic fluid from the intestinal juices, as to the disturbance of function of all the digestive organs through their close nervous association. Pain is frequently felt in the left side. The pancreas is in direct relation with the left kidney and its pelvis. The patients' symptoms along the left ureter were no doubt due to this fact. Failure to get urine when the left ureter was catheterized during an attack of pain was probably due to a suspension of the function of the left kidney on account of its relation to the pancreas, which was at that time acutely disturbed. The fact that in the tissue removed the islands of Langerhans are seen to be well preserved and that no sugar was found in the urine, agrees with Opie's theory regarding the cause of pancreatic glycosuria. It has been established by Opie⁶ that pancreatic glycosuria is due to a destruction of the islands of Langerhans. Glycosuria therefore is not present in chronic pancreatitis until late in the course of the disease or during a severe and acute exacerbation.

A complete stoppage of pancreatic fluid had not occurred in this case, and there was no disturbance of the flow of bile, so that changes in the fæces were not noticeable. A hemorrhagic tendency was not present in this case. Some observers have attributed a hemorrhagic tendency to chronic pancreatitis when it should have been ascribed to a complicating cholæmia.

Though we propose to extend the operation just described to the treatment of all cases of chronic pancreatitis not relieved by gall-bladder drainage, it is particularly chronic pan-

creatitis accompanied by stone formation in the pancreatic ducts that we wish to consider at present.

Pancreatic lithiasis has been recognized since Graaf reported the first case in 1671. For many years it was the only condition in which chronic pancreatitis was known. It has not been successfully produced in animal experimentation, but its generally accepted cause is a catarrhal inflammation of the ducts and stagnation of secretion. Calculi are most often found in the duct of Wirsung and range in size from a millet seed to a walnut. The stones removed in Ruth's case weighed 280 grains.

In some cases a single stone the size of a bean may lodge so as to produce complete obstruction at the duodenal orifice of the pancreatic duct. This is followed by violent symptoms, an acute inflammation of the pancreas, glycosuria, and death in a few days from fatty degeneration. A review of a large number of carefully reported cases shows that this is the unusual type. Owing to the shape of the stone and the ability of the duct to expand, complete obstruction very rarely occurs. A partial obstruction, the most common condition, brings about a pathologic process extending over several years, during which time symptoms of greater or less severity are present. The inflammation first causes a considerable enlargement of the gland, which finally begins to contract and gets smaller and smaller, until at autopsy the pancreas may be only a thin covering to a dilated duct filled with stones. In partial obstruction the patient's condition takes a slow, chronic course, characterized by emaciation. Sometimes he is reduced almost to a skeleton; or before reaching this stage of extreme emaciation, death occurs from pulmonary tuberculosis and diabetes. Let me repeat that in chronic pancreatitis, diabetes always indicates either an advanced stage with destruction of the gland or an acute exacerbation of severe degree.

In a large number of cases stone formation is not confined to the ducts of Santorini and Wirsung. The dilatation of the main ducts extends along the smaller tributaries, and we find calcareous particles deposited even in the finest acini. This

condition I am pleased to call parenchymatous calculosis. Ziegler⁷ says of this condition: "Small concretions are sometimes diffused in the form of sandy grains throughout the gland substance." This must not be confused with those cases in which the main ducts are lined with calcareous material without the formation of calculi, designated by Robson⁸ as pancreolithic catarrh. Recognition of the type of calculosis at operation is important, as upon that depends the nature of the operative measures necessary. When stones are found only in the ducts of Wirsung and Santorini, they can be removed by pancreatotomy, as has been done by Moynihan⁹ and by Robson.¹ If, however, we have calcareous particles also in the small ducts and in the acini, to remove all of them is impossible. In that case we can only remove those stones in the main duct and establish permanent drainage by pancreatostomy, both to obtain the effect of the drainage on the inflammation always present, and also to be able to control the obstruction of the ducts by new stones that are sure to form.

Upon reviewing the operations done for stone in the pancreas, we find on record six cases reported by Gould,¹⁰ Allen,¹¹ Dalziel,¹² Moynihan,⁹ Robson,¹ and Ruth.¹³ Of these, four recovered, though one in whom simple pancreatotomy was done has since had return of symptoms. A bad result is most apt to occur from failure to get all the stones and to completely relieve the obstruction. It is plain that direct drainage by bringing the tail of the pancreas out and establishing a pancreatostomy is indicated in those cases where stones are found in the pancreas, unless only a few stones are present and their removal is feasible.

Owing to the rarity of this condition, one may not expect to be called upon to do this operation many times. However, an established technic for dealing with chronic pancreatitis and pancreatic lithiasis will encourage the performance of exploratory laparotomy in suspected cases of pancreatic disease and will assist in dealing with those unlooked-for conditions met on the operating table.

Pancreatostomy may also be used to prolong life in cases

of complete obstruction of the main duct from neoplasms. A dilated duct is not necessary for this operation, though it is present in most cases of obstruction at the duodenal orifice of Wirsung's duct. My experience proves that if a trench is cut in the gland, the bottom of which reaches and opens the duct, drainage is safely obtained if a tube is placed in the bottom of the trench and the gland substance closed around it. The fact that healing can occur between cut surfaces of the pancreas in the presence of its own secretion is established.

To the excellent experimental work on pancreato-enterostomy of Robert C. Coffey¹⁴ I am indebted for the impetus to perform pancreatostomy. One of the deductions made by Senn in his experiments on the pancreas was that complete section of the pancreatic duct results uniformly in obliteration of the duct at the site of section. For that reason I would prefer pancreatostomy, so that the duct can be kept patent, instead of pancreato-enterostomy as proposed by Coffey. This is especially necessary in the presence of lithiasis, where stones are frequently escaping and where without assistance, such as probing, the duct might become occluded anew.

The pancreas may be approached through the mesogastrium, through the gastrocolic omentum between the greater curvature of the stomach and the colon, and through the mesocolon. In my case I chose to operate through the mesocolon. Several repetitions of this operation, on the cadaver, have convinced me that the route through the mesocolon is preferable. It affords sufficient room for manipulation in the lesser cavity. It permits fixation of the pancreas in the lower angle of the wound, thus favoring drainage. If the pancreas is brought through between the stomach and the colon (Fig. 6), the greater curvature of the stomach, which normally varies much in its position at different times, would be fixed. The gastrocolic route possesses the sole advantage of permitting better exposure of the pancreas during operation. At another operation I would dispense with the gauze drainage around the pancreas, depending upon careful sewing and the fact that the tissues can dispose of pancreatic secretion if asepsis

obtains and no serious injury is added to the presence of the fluid.

Reports of death from chronic pancreatitis, both with and without pancreatic calculi, are not at all uncommon in medical literature. Invariably the cases were under observation over an extended period of time, and an approximate diagnosis was often made during life. It is our hope that the success of this operation may stimulate others to operate on those cases which heretofore have been considered beyond relief.

REFERENCES.

- ¹ Robson and Cammidge: *The Pancreas—Its Surgery and Pathology*, Philadelphia and London, 1907.
- ² Mayo, W. J.: Pancreatitis Resulting from Gall-stone Disease, *Journal of the American Medical Association*, April, 1908, vol. 1, p. 1161.
- ³ Pepper, William: Clinical Remarks on Several Cases of Pancreatic Disease, *Medical News*, Philadelphia, 1882, vol. ii, p. 678.
- ⁴ Senn, N.: The Surgery of the Pancreas, *Transactions of The American Surgical Association*, 1886, p. 114.
- ⁵ Von Mikulicz-Radecki: Surgery of the Pancreas, *ANNALS OF SURGERY*, 1903, vol. xxxviii, p. 1.
- ⁶ Opie, E. L.: *Disease of the Pancreas*, Philadelphia and London, 1903.
- ⁷ Ziegler, Ernst: *A Text-Book of Special Pathological Anatomy*, New York and London, 1897, p. 758.
- ⁸ Robson, A. W. Mayo: Anatomy of the Pancreas in Relation to Its Diseases, *British Medical Journal*, May, 1908, p. 1153.
- ⁹ Moynihan, B. G. A.: On Pancreatic Calculus, *Lancet*, 1902, vol. ii, p. 355.
- ¹⁰ Gould, A. Pearce: *Trans. Clin. Soc. of London*, *Lancet*, 1898, p. 1632.
- ¹¹ Allen, L. W.: Chronic Interlobular Pancreatitis, *ANNALS OF SURGERY*, 1903, vol. xxxvii, p. 740.
- ¹² Dalziel: *Proceedings British Med. Soc.*, *British Medical Journal*, 1902, p. 310.
- ¹³ Ruth, C. B.: Transperitoneal Retrogastric Surgery, with Report of a Case of Pancreatic Calculi and One of Retrogastric Sarcoma, *Colorado Medicine*, October, 1907.
- ¹⁴ Coffey, Robt. C.: Pancreato-enterostomy and Pancreatectomy, *ANNALS OF SURGERY*, 1909, vol. 1, p. 1238.

ACUTE HEPATITIS SIMULATING STONE IN THE COMMON DUCT AND LIVER ABSCESS.

BY JOHN W. CHURCHMAN, M.D.,

OF BALTIMORE, MD.,

Instructor in Surgery in Johns Hopkins University.

THE studies of recent years in the pathology of the liver have resulted in a revision of the early conceptions of both parenchymatous and interstitial hepatitis. The disease has gradually been proven not susceptible to the simple classifications so long in use, and the various processes of inflammation, degeneration, necrosis, and regeneration have been so often found in one liver that the attempt to assign to a symptom complex, constant and characteristic lesions has been abandoned. Ideas have been modified very much, as in the case of nephritis. Experimental work has demonstrated the complex nature of liver changes and the part played in them by the various factors of infection, intoxication, autolysis, and regeneration; and autopsy findings have demonstrated how varied are the lesions associated with a given clinical picture. The terms "acute" and "chronic," "intralobular" and "interlobular" are no longer favorably regarded; cirrhosis is not considered a disease *sui generis*; still less is it admitted that the various forms of liver cirrhosis are distinct diseases. "All ground," says Kretz,¹ "for regarding cirrhosis as an entity, disappears." A place is reserved by some pathologists for the smooth, hypertrophic form with jaundice, which is regarded as sufficiently characteristic to deserve separate consideration. But Meyer,² and with him many modern pathologists, is unwilling to make even this concession, denying the existence of Hanot's cirrhosis as a distinct disease.

The newer views affect our conception not only of the interstitial but also of the parenchymatous lesions. It is now recognized that these, too, may be present in a given liver in the most varied form; and that there is no ground for ex-

pecting to find associated with a given symptom complex a constant, or even a characteristically predominating, parenchymatous lesion. Rokitansky's acute yellow atrophy seems to have survived criticism, as do the various types of syphilitic cirrhosis. But there is reason for the belief that even these types are not so sharply differentiated as had once been supposed.

In view of these facts there is no ground for the hasty assumption that new diseases have been established by finding "hitherto undescribed" hepatic changes.

The present cases, though associated with unusual lesions in the liver, are reported because of their clinical importance. They are examples of an uncommon disease and are of a good deal of diagnostic interest.

CASE I.—*Weakness and loss of appetite, with vague abdominal pains for two years; jaundice and cough for three weeks; diurnal and bidaily chills (97.5° to 106.5°), with sweats and some pain in the right side; complete obstructive jaundice, unchanging in degree; enlarged, slightly tender liver; some nausea; negative Wassermann and Widal; purpura of the ankles; no malarial parasites. At autopsy, gall-bladder and ducts normal; no stones; liver enlarged; moderate degree of cirrhosis with diffuse necrosis of the parenchyme; no organisms (smear, sections, and blood culture): no syphilis.*

The patient was a married woman of fifty, who had suffered for two years with vague pain in the right side. She had gradually grown weaker and had lost her appetite. Three weeks before admission she had "taken cold," and since then had been troubled by a cough. During this time jaundice had appeared and had gradually increased. She had complained of "uneasy feelings" in the stomach, but there had been no sharp pain, nausea, or vomiting. The bowels were regular. She gave a not very clear history of "some chills and fever." On the night of admission she had a shaking chill, accompanied by pain in the right side, and followed by a profuse sweat. The temperature rose to 105°, pulse 95, leucocytes 11,880. No malarial parasites could be found. The patient was extremely jaundiced and much emaciated. The tongue was heavily coated,

but there was no herpes. The abdomen was everywhere soft, but was fuller below the costal margin on the right than on the left side. The liver dulness reached 3.5 cm. below the costal margin in the R.M.L. During the next few days, the patient continued to have diurnal and bidaily chills, with sweats, headache, nausea, and palpitation. There was a muttering delirium when the fever was at its height. The jaundice persisted unchanged. The stools, which were acholic and fatty, contained

CHART I.

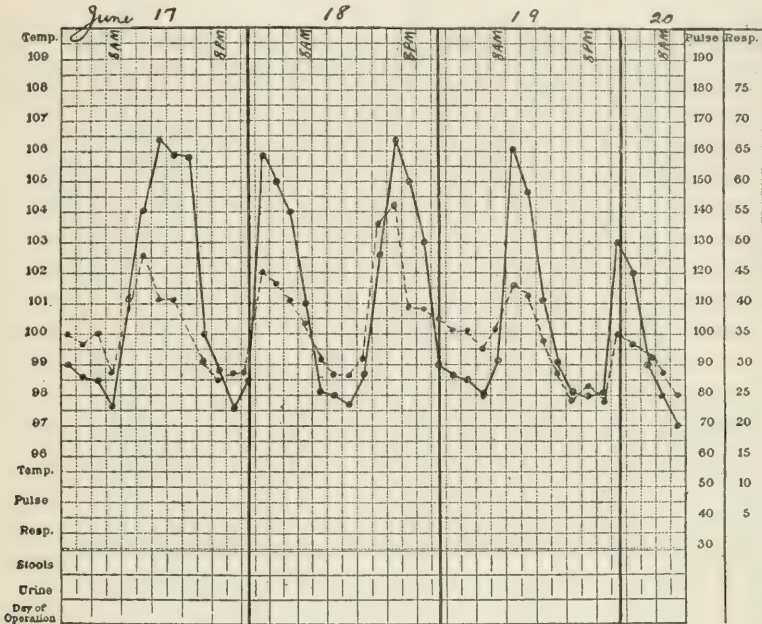


Chart showing pulse and temperature for a few days of the illness in Case I.

no blood. There was abundance of bile in the urine. Over the abdominal fulness in the right upper quadrant there was slightly increased resistance, but no marked tenderness or muscle spasm. The Wassermann reaction was negative. No variations in the jaundice or attacks of gall-stone colic occurred. The character of the fever is shown in the temperature chart (Chart I). At the time of the chills there was no particular abdominal pain, but tenderness was present in the right upper quadrant and extended into the flank. The gall-bladder could not be felt.

The Widal reaction was negative. Hæmoglobin 38 per cent.; coagulation time 6 min. Two weeks after admission purpuric spots appeared on both ankles. The patient was rapidly going down hill, and, though evidently too ill for an exploration of the common duct, it was felt that a palliative drainage of the gall-bladder might relieve the symptoms if due, in part, to infection of the bile-passages. At operation, the peritoneal cavity was found to contain a small quantity of bile-stained fluid. The gall-bladder and bile-ducts were normal. On the under surface of the liver there were numerous whitish-gray spots, which looked like minute abscesses and reminded us of a case of acute hepatitis seen shortly before (the second case here reported). Rapid closure was done. The down-hill course continued, uninfluenced by the operation, and the patient died two days later. At the autopsy the only findings of interest, aside from the liver lesions, were a slight excess of peritoneal fluid, firm adhesions about the spleen, between the liver and duodenum, and between the duodenum and right kidney. There was an acute splenic tumor, and a vegetation on the aortic valve, smears from which failed to show organisms.

The liver weighed 2800 Gm. and measured $31 \times 24 \times 7.5$ cm. The outline was well preserved and the enlargement was uniform. There were dense adhesions on both diaphragmatic and lower surfaces. The capsule was not thickened, and through it one could see depressed scars. The lobulation was much obscured, in places could not be made out at all. Jaundice of the liver tissue was quite marked. The organ was like rubber in consistency and cut with some difficulty. On section the picture was pretty uniform throughout. The architecture was obscure; and in general the picture suggested a certain amount of cirrhosis. There were depressed scars with conspicuous raised areas of parenchyme, some of which measured 2 to 3 mm. in diameter. These nodules of parenchyme were of various colors (gray, yellow, red, green), or were quite opaque. There was apparently acute inflammation and necrosis of the liver tissue, with staining of all the elements with bile pigments. Cultures made at autopsy from the heart's blood showed no organisms either aërobically or anërobically.

Microscopically, the fat stains showed a large amount of fat. In parts of the liver, greenish or bronze-colored pigment was abundant. There was a wonderful grade of parenchymatous degeneration. This had affected all parts of the liver and almost none of the liver cells were normal. Some of them showed a granular or hyaline necrosis involving a part or all of the protoplasm. Others contained many vacuoles. Others were represented by a pink granular detritus. Poly-

morphonuclear neutrophiles were abundant, and there was much oedematous new-formed connective tissue. There were enormous numbers of new-formed bile-ducts. The capillaries were greatly congested, and large numbers of red blood-cells were present throughout the section.

CASE II.—*Malaria 25, syphilis 10, and pneumonia 8 years before admission. Onset of present illness two weeks before admission, with malaise, asthenia, and nausea; dull pain in right hypochondrium; fever (99.5° to 104.2°) and night-sweats; loss of twenty pounds; liver enlarged; tenderness in right upper quadrant of abdomen; Wassermann reaction positive; Widal reaction and blood culture negative. At autopsy, syphilitic aortitis; gall-bladder and ducts normal, no stones; diffuse cirrhosis of liver and necrosis; no abscess.*

The patient, a man of forty-two, had had a primary luetic infection with secondary symptoms ten years before admission. An attack of pneumonia eight years, and of tertian malaria twenty-five years, before were (with the exception of moderate constipation) the only other points of interest in the previous history. The present illness began suddenly fourteen days before admission, with general malaise, dizziness, weakness, and nausea following exposure to the wet. The following morning a dry cough developed and the patient began to experience a dull, aching pain in the right hypochondrium. He vomited once on the second day of the illness but not again. Fever, night-sweats and great weakness were the chief symptoms during the next few days. His appetite was fair, bowels irregular. A constant dull ache, worse at night and on deep inspiration, persisted in the right side. The pain did not radiate and there had been no attacks of colic. He had lost twenty pounds since the onset of the illness. He was moderately well nourished, with flushed cheeks, cyanotic lips, and a slight jaundice. Numerous medium râles were heard throughout the chest. The abdomen was quite tense throughout. At a point about 5 cm. to the right of the umbilicus there was tenderness, but none elsewhere. The respiratory movements were free and there was no muscle spasm. The spleen was not felt and there were no rose spots. The Wassermann reaction was positive, the Widal reaction and blood culture negative. There was a trace of albumin, but no casts in the urine. The liver was enlarged,

its border rounded. The character of the fever is shown in the temperature chart for the early days of the illness (Chart II). The symptom complex, together with a slight rise of the border of the lung on the right side, justified a probable diagnosis of liver abscess. At the exploratory operation, there was no fluid in the peritoneal cavity. The gall-bladder and ducts were normal. The liver was large, succulent, and covered with small grayish-

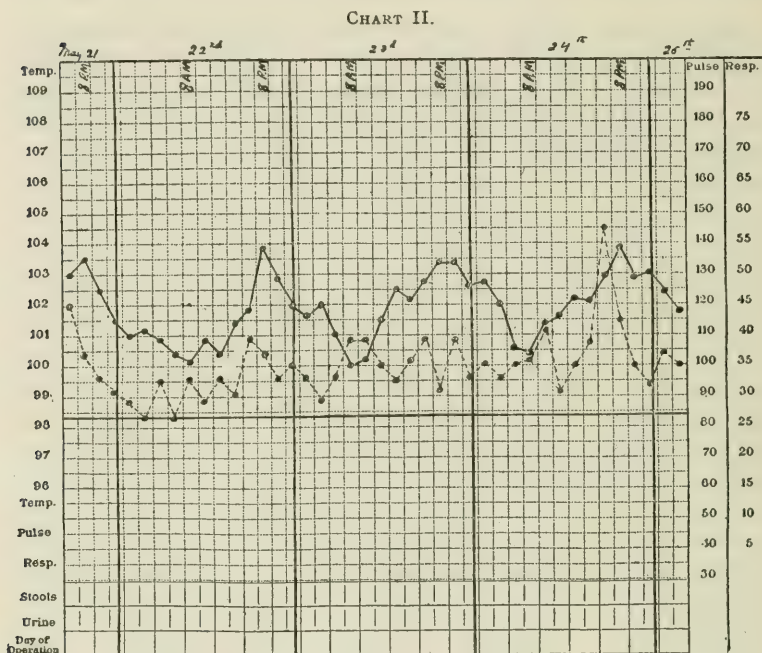


Chart showing the temperature and pulse for the early days of the illness in Case II.

white specks resembling abscesses. The liver was thoroughly explored with a needle but no pus encountered. During the ten days following operation there was extreme weakness, profuse perspiration, some distention, but no vomiting, and death occurred in extreme prostration.

At the autopsy, except for the liver lesions, the only features of interest were a slight enlargement of the spleen and a definite syphilitic aortitis. The gall-bladder and ducts were normal and there were no stones. The liver weighed 4000 Gm. and measured 30 x 20 x 9 cm. The capsule was thin. The organ was uniformly enlarged and its architecture

perfectly preserved. It was pretty uniformly mottled with opaque yellowish dots about $\frac{3}{4}$ mm. in diameter. The liver cut with some difficulty. The surface was not quite smooth, showing here and there irregular depressions evidently due to increase of connective tissue in the portal spaces. The liver lobules varied much in size, some being quite large and swollen and standing out beyond Glisson's capsule, others small and distorted. In many places the gross picture suggested pretty extensive necrosis. Smears made from a few small pockets, which contained grumous material suggesting pus, showed no pus-cells or organisms, and cultures made from the liver were sterile. Microscopically, the connective tissue of the portal spaces was everywhere increased and infiltrated with leucocytes, chiefly polymorphonuclears. The bile-ducts were much increased in numbers; all of them were dilated and filled with leucocytes and coagulated serum. In some places the ducts were so numerous as to suggest adenomatous growth. There was no degeneration of the lining epithelium of the ducts and no desquamation. The liver cells for the most part stained well, although they were swollen and granular. In many places they were atrophied, apparently by the pressure of the connective tissue. In places there was much brown pigment. In general, the pathological picture was not so striking as in the first case. Destruction of the parenchyme was less marked, increase of connective tissue more marked. More noticeable too was the great proliferation of the bile-ducts.

A small number of cases somewhat similar to these have been reported and the conclusion drawn that a separate clinical entity had been established. Curschmann,³ in 1899, described a specific form of hepatitis, with necrosis, based on the observation of two carefully reported cases.*

CASE I.—Woman of fifty-one, attacks of gall-bladder colic for one year; ten weeks before admission a mild attack, with loss of appetite, nausea, and almost daily vomiting; three weeks before admission jaundice, which had not been previously present even after the attacks of colic. Liver not enlarged, not tender; jaundice constant in degree; stools brown; moderate amount of bile in urine; irregular fever, only twice exceeding 39° ; pulse about 110; death ten days after admission. Autopsy: common duct thickened and enlarged; stone lying loose in common duct; abscess about cystic duct, with which it communicated by a perforation; liver slightly enlarged and showing numerous whitish spots, which looked like abscesses but contained no pus; diffuse central and midzonal necroses, with cirrhosis about the enlarged and proliferating gall-ducts.

CASE II.—Woman of forty-three, typhoid 12 years before admission; attacks of gall-stone colic, with jaundice, for two years; sharp attack,

* Incomplete reports of one or two other cases are also given.

with chill, three months before admission, followed by loss of appetite, frequent vomiting, alternating diarrhœa and constipation; temperature irregular, seldom much above normal; stools slightly colored; small amount of bile pigment in urine; jaundice practically unchanging in degree. At autopsy, gall-stones in gall-bladder. Cystic duct closed by a scar. Loose gall-stones in common duct, which was much dilated. Gall-bladder thickened and shrunken.

What Weber⁴ regarded as a similar condition, he reported under the title "*Hepar necroticum cum ictero*" (of Curschmann and Oertel). His patient suffered from deep jaundice, colorless stools, much emaciation, and ascites. There was a septic temperature. At autopsy a tumor of the head of the pancreas and dilated gall-ducts were found.

Extensive liver necrosis has been the feature common to the cases of Curschmann, Weber, and the author. The constant exposure of the liver to injurious agencies from the intestines, its double blood supply, the susceptibility of its cells to many mineral and proteid poisons, and its exposure to the effects of mechanical obstruction in the bile passages make such necroses not uncommon. The importance of infection in these processes has long been understood, but the part played by other factors is becoming clearer. Evidence is accumulating to show that the site of the necrosis within the lobule may be some indication of the cause of that necrosis. The association of a peripheral necrosis with pregnancy, for instance, is well known. Midzonal necrosis is regarded as so frequently connected with intense bacterial infection that the latter must be considered the most important factor in its production. In central necrosis, too, some form of acute infection must be regarded as the essential factor, though vascular disturbance may predispose to the lesion. The picture seen in a liver may, however, be altered by a combination of these factors. Opie,⁵ for instance, using a poison which *alone* would not cause midzonal necrosis, in combination with a relatively non-virulent organism (*B. coli*), was able to produce typical midzonal lesions. He thinks it probable that the organism retards the parenchymatous regeneration after destruction by the poison. Moreover, the picture has been shown

to change with the intensity of the intoxication and the time during which it acts on the liver. Flexner, using large doses of ricin and abrin, produced hepatic cell destruction without proliferative changes in the connective tissue; while smaller repeated doses of the same drugs led to the new formation of connective tissue and proliferation of the bile-ducts. Naunyn also showed that organisms introduced in large quantity into the ligated common duct might cause liver necroses, without any sign of suppuration, and that this rapid death of the liver cells might result fatally in seventy-two hours. Certain digestive or autolytic processes probably also play a part in the final pathological picture in some instances of hepatic disease. Salkowski⁶ and others have shown that the albuminous bodies of liver and muscle, under conditions in which bacterial action is excluded, are split into leucin, tyrosin, purin bodies, and albumoses, that this process may go on during life, and that it is probably of importance in explaining liver necroses.

The liver under conditions of disease may thus be exposed to the action of a large number of injurious agents. These agents may act singly or in combination; they may act intensely for a short, or mildly for a long, period; and a great variety of lesions therefore results. Many of these changes may be observed at one time in a given liver. If the common duct, for example, be occluded for some time, changes in the liver will be produced by the long-continued bile stasis. But infection may also be present and additional lesions be produced by the organisms. Finally, absorption of albuminous toxins from the intestines may modify the final picture. A liver examined at various stages in such a disease would present the most varied pictures—no one of which could be regarded as the “typical picture of biliary cirrhosis.”

It is for reasons of this sort that attempts to establish sharply demarcated groups of hepatitis are unwarranted, and there is no evidence for the belief that the hepatitis described by Curschmann was a specific form. Both his patients had stones in the common duct. The first had a perforated cystic

duct with abscess; the second, gall-stones in the gall-bladder. Both had had repeated attacks of colic; jaundice was present in both cases, of long duration in the first case. The clinical picture was that of long-continued cholelithiasis, the liver changes probably contributing, as they often may, to the symptom complex in the last stages of the disease. The moderate degree of the jaundice and the fact that the stone was loosely lodged in the common duct hardly justify Curschmann's conclusion that the final clinical picture represented a distinct entity, referable to the liver rather than to the gall-stones. The effects of bile stasis on the liver are variable and the human liver is thought to be relatively resistant to this factor. Yet Janowski,⁷ in a study of the liver in ten patients dead of cholelithiasis, described one case which showed central necroses scattered throughout the liver—changes quite similar to those in Curschmann's cases. Experimentally, the effects on the liver of ligation of the common duct have varied with the animal used.

No bacteriological study of Curschmann's cases was made. Yet infection was obviously present and cannot be disregarded. Naunyn was able experimentally, by injection of *B. coli* into the ligated common duct, to produce extensive liver necroses. Curschmann's communication is only of value because it calls attention to the rôle played by the liver in the late clinical picture of cholelithiasis—a rôle often overlooked in the interest in the stones themselves. A similar criticism must be made of Weber's communication. His patient showed obstructive jaundice, ascites, enlarged liver, and fever; but inasmuch as an obstructing tumor of the head of the pancreas and dilated gall-ducts were found at the autopsy, the mere presence of multiple disseminated lobular necroses hardly justifies the consideration of the disease as a separate clinical entity.

In 1908 Oertel⁸ described in some detail four cases associated with a multiple, non-inflammatory necrosis of the liver, which he thought to be characteristic of the condition and similar to the lesions described by Curschmann. He applied

to the disease the name "Hepar necroticum cum ictero." The clinical picture, so far as one can gather from the meagre histories, was not characteristic. Jaundice and symptoms of intoxication (fever, mental disturbance, and delirium) seem to have been the chief features. All the patients were in a state of generally lowered nutrition, showed marked degenerative changes throughout, and had been exposed for some time to unhealthy modes of living. Common to all the cases was a peculiar and characteristic multiple and irregular destruction of the liver tissue, with more or less pronounced bile and blood stasis and fatty change. There was entire loss of the liver markings. The organ was leathery and pale yellow. There was a complete lack of inflammatory reaction within the liver tissue, and the sclerosis was confined to the portal spaces. The parenchymatous lesion appeared to be an unusual fading and gradual disappearance of the liver cells, with complete retention of the cell-outline, so that ultimately only "ghosts of cells" persisted.

Whether the changes described by Oertel are to be regarded as characteristic enough to entitle them to separate consideration is open to grave doubt. But, on the other hand, there is no doubt whatever that the clinical significance of extensive and relatively acute liver destruction—as illustrated by his cases and the cases reported in this paper—deserves emphasis, and this emphasis may be made without attempting to establish "hitherto undescribed" forms of hepatitis.

One of the interesting features of the cases here reported was our complete inability to demonstrate any cause for the hepatic change. The character of the temperature suggested an infectious origin, but blood cultures were negative, and no organisms could be found either in smears from the liver or in sections. The failure to obtain positive cultures from the liver has, however, only relative value. It was shown years ago by Babes⁹ that in patients dead of streptococcus septicæmia with extensive liver necroses, the organisms, though present in the blood, could not be grown from the liver; and that, in experimental streptococcus septicæmia, if the animals

lived longer than eight days after the injection, the organism could not be cultivated from the degenerated internal organs. There seems to be some reason for believing that this fact is due to the production of bactericidal properties from the albuminous molecule in the liver (Conradi).

Nor did the absence of signs of suppuration in the liver exclude infection, for the observation has been repeatedly made that organisms in large quantity may produce destructive parenchymatous lesions without the usual suppurative changes. It seems, indeed, altogether likely that these cases of destructive liver lesions, with fever and symptoms of intoxication, are often due to absorption from the intestines even when an infection cannot be absolutely demonstrated (Chauffard's toxi-infection).

In the second case here reported, the large, ulcerated, and thrombosed hemorrhoidal vessels must be thought of as a possible source for the infection. In some of the greatly dilated veins softening and ulceration of the thrombi had occurred, whereby the thrombus connected, through the ulceration, with the lumen of the gut. There was no sign of ileocolitis.

Syphilis cannot be disregarded in a discussion of acute destructive hepatitis with fever. The clinical features of this form of syphilis have been referred to by Gerhard, Frerichs, Hirschberg, Klemperer, and others, who have reported cases with fever either of the continuous or the irregularly remittent type; and Nasarow¹⁰ has made the point that the liver in these cases is almost always hypertrophic. Mannaberg¹¹ reported a patient who, on the basis of a malarial temperature chart, was treated for that disease for one and a half years; the fever disappeared rapidly with antiluetic treatment and complete recovery occurred. Osler and Churchman¹² include under Group 5 of their classification of luetic hepatitis cases resembling liver abscess. Unfortunately not a great deal is known of the pathology of these conditions, and the part played by lues has not been made absolutely clear by post-mortem examinations. In the cases reported in this paper, the pathological picture was quite different from that seen in

syphilis, but it is to be recalled that the old ideas in regard to luetic hepatitis are undergoing some change, and the ability to recognize the disease more often, by the Wassermann reaction, seems likely to make further changes still. Adami,¹³ for instance, while acknowledging the relative infrequency of the extensive diffuse liver lesions in the acquired form of the disease, states that "the lesions occurring in the congenital and in the acquired disease are identical, and that the same processes are at work in the secondary and tertiary stages; no sharp line between them can be drawn." Unfortunately, the failure to find the *Treponema pallidum* in the liver is of little value in excluding syphilis. Cases are reported (Veszprémi and Kaniz¹⁴ and Buraczynski) in which the organisms were present in considerable numbers in the specific skin lesions, but could not be found in the liver; and failure of this sort has been the general experience. Specific luetic liver changes have not been found in these cases, the diagnosis resting on the presence of other definite syphilitic processes or on the recent syphilis. The question might therefore be raised whether these were not cases of acute toxi-infectious hepatitis occurring in the course of syphilis, rather than instances of true luetic hepatitis. The complete response of symptoms to specific treatment in a group of clinically similar cases establishes the existence of syphilitic hepatitis with fever; but it unfortunately precludes the possibility of post-mortem evidence as to the liver changes in the cases known to be syphilitic.

In the two patients here reported the lesions in the liver were quite unlike those usually associated with syphilis. Sections stained by the Levaditi method failed to show the organisms of Schaudinn. In the first case, syphilis could be absolutely excluded, on the absence of infection, the negative Wassermann reaction, and the absence of syphilitic lesions in any of the organs at autopsy. In the second case, the patient had undoubtedly had syphilis, as shown by the positive Wassermann reaction and the presence of specific aortitis; but there is no evidence whatever that the liver lesions from

which he died were of specific nature. In view, however, of the unsettled state of knowledge in this respect, the Wassermann reaction is essential in patients exhibiting the symptom complex here described, and the therapeutic test should always be tried.

Acute yellow atrophy, though now recognized as occurring in a number of conditions, is still regarded as a definite pathological entity, and the early stage of the disease is sometimes associated with enlargement of the liver. This disease could be positively excluded in my cases by the gross and microscopic appearance of the liver, as well as by the absence of diminution in the size of the organ even in the late stages of the disease. Certain of the symptoms corresponded with those seen in the second (cholæmic) stage of acute yellow atrophy. Fever is not, however, a characteristic symptom of this disease; it is often, indeed, described as afebrile.†

The cases here reported illustrate the importance of a grave, acute disease associated with enlargement of the liver, some increase in the connective-tissue elements, and a high grade of parenchymatous destruction. The symptoms produced are jaundice, complete or nearly complete absence of bile pigment from the stools, fever like that seen in common-duct stone or in liver abscess, and manifestations of profound intoxication. Although the clinical picture suggested a bacterial origin, none could be demonstrated. Syphilis was excluded; but this disease, though usually producing changes in the liver quite different from those seen here, is known to cause hepatic lesions varying all the way from the common catarrhal jaundice to the "acute yellow atrophy of syphilis"; and some of the reported instances of luetic hepatitis have resembled clinically the cases in this paper. In view of the fact that liver changes of varied kinds—both as regards pathological picture and etiology—have been found in asso-

† Fever is often present during the initial catarrhal icterus, but later the temperature is, as a rule, normal. In the second stage it may become subnormal, though an agonal rise (sometimes very high) is often seen. Quincke in Nothnagel's System, Volume on Liver, Pancreas, and Suprarenal Glands. See also Kelly in Osler's "Modern Medicine," Vol. V.

ciation with this grave clinical condition, it is unwise to attempt to classify it pathologically and equally unwarranted to attempt to establish a close connection between this symptom complex and a "characteristic" liver change. Clinically, the condition is a very acute one, but in many cases chronic cirrhosis undoubtedly exists for a long time without producing symptoms, and is only recognized when (probably owing to some complication) grave symptoms supervene. So that even the word "acute" must be used cautiously in this connection. Icterus gravis primitivus describes, though somewhat vaguely, the clinical picture and takes account of the absence of demonstrable cause. Degenerative, productive hepatitis with enlargement indicates the main lesions and correctly emphasizes the element of destruction. Both names rightly imply the existence of an acute disease of the liver distinct from acute cloudy swelling, acute yellow atrophy, suppurative cholangitis, and liver abscess. The fact of the existence of such a disease is of more importance than its name; and its resemblance to liver abscess or stone in the common duct is of some importance in diagnosis.

Both cases were treated in the surgical service of Dr. Halsted, whose accustomed generosity with his clinical material it is again a pleasure to acknowledge. The second case was under the care of Dr. Thayer and Dr. Finney, who kindly allowed me to use it for study.

BIBLIOGRAPHY.

- ¹ Kretz: *Verhandl. d. deutsch. path. Gesell.*, viii, 54, 59.
- ² Meyer: *Münch. med. Woch.*, 1908, lv, 2276.
- ³ Curschmann: *Deutsch. Archiv f. klin. Med.*, lxiv, 1899, 564.
- ⁴ Weber: *Proc. Royal Soc. Med.*, Lond., 1908, 113, *Path. Sect.*, 109.
- ⁵ Opie: *Proc. Path. Soc. Phila.*, Sept., 1910, 145.
- ⁶ Umber: *Berl. klin. Woch.*, 1903, 185 (quotes Salkowski).
- ⁷ Janowski: *Beitr. zur path. Anat.*, Bd. xl, 1892, 344.
- ⁸ Oertel: *Journ. Med. Research*, 1904, vii, 75.
- ⁹ Babes: *Virchow's Archiv*, 1894, Bd. cxxxvi, 1.
- ¹⁰ Nasarow: *Wien. klin. Woch.*, 1908, xxi, 1736.
- ¹¹ Mannaberg: *Zeitsch. f. klin. Med.*, 1907, lxii, 253.
- ¹² Osler and Churchman: *Chapter on Syphilis, Modern Medicine*, iii, 481.
- ¹³ Adami: *Montreal Med. Journ.*, June, 1898.
- ¹⁴ Veszprémi and Kranitz: *Archiv f. Derm. u. Syph.*, lxxxviii, 1907, 35.

THE RATIONAL TREATMENT OF ACUTE APPENDICITIS.*

BY JOHN B. DEAVER, M.D.,
OF PHILADELPHIA.

APPENDICITIS is a disease with which the medical profession has been familiar for many years. It has been carefully studied by many observers. Large series of cases have been gathered, and there is no lack of material for a comparative study of various methods of treatment. In spite of these facts, it must be admitted that there exists among surgeons and medical practitioners a great divergence of opinion as to the proper method of procedure in certain cases and at different stages of the same case.

The appendix in its anatomical relation differs from every other abdominal organ with which we have to deal. It is usually easily accessible. It can be completely removed, unless extensive surrounding disease be present, apparently without in any way interfering with the bodily functions. While we need not consider it a vestigial structure or a functionless organ, nevertheless its removal has in my experience never been followed by bad functional results of any kind. Its removal also is not usually a matter of great technical difficulty, unless complicating conditions place obstacles in the way of the surgeon.

Situated as the appendix is, more or less separate from other structures, it can yet give rise to most extensive inflammatory conditions within the abdomen. It is well known to be the most frequent causative factor in acute abdominal conditions requiring surgical intervention. Appendicitis is by far more frequent, in this country at least, than any other con-

* Read before the Philadelphia Academy of Surgery, February 6, 1911.

dition within the abdomen, acute or chronic, which is met with in surgical practice.

It seems strange then that since appendicitis is except in but comparatively few cases easily diagnosed, the organ so often accessible, and its removal, when no complications are present, so easy, that there should still be such a considerable mortality in dealing with acute appendicitis.

This mortality remains more than it should be for four reasons: (1) failure to diagnose the disease sufficiently early; (2) failure to recognize its gravity; (3) postponement of prompt surgical intervention; (4) incorrect treatment in the later stages of the disease.

The diagnosis of acute appendicitis has been sufficiently dwelt upon in many articles within the past twenty years. It is usually easy if a careful history has been taken and a careful examination of the patient made. I am convinced that most errors in the diagnosis of this, as well as of all other of the commoner surgical conditions of the abdomen, depend not so much upon any great obscurity of the symptoms as upon the failure of the medical attendant to carefully construct the clinical picture. Many of us have seen instances in which acute appendicitis has been treated under the impression that the pain was caused simply by gastritis or colic. The examination in such cases is most superficial, and indeed I have seen numerous instances in which a careful abdominal examination had not been made until two or three days had elapsed, or not at all. It is but rarely that the sequence of pain, vomiting, and tenderness, with localization of pain in the right iliac fossa, is not observed, and practically never are local signs absent. The only excusable way in which the physician or surgeon might fail to make a diagnosis, a few cases excepted, is in children too young to state their subjective symptoms or accurately to locate the pain and tenderness.

But while a diagnosis of acute appendicitis can and should be promptly made in practically every case, it is a false refinement of diagnostic methods to attempt to give a definite

prognosis early in the disease. We may of course gauge the comparative severity of the lesion by the severity of the onset, the patient's condition, and the rate of progress of the disease. Yet it must be remembered that often cases in which the symptoms are most severe do not show lesions more grave than those in which the disease apparently had started as a mild process. This leads us to the consideration of the second factor influencing the mortality of the disease, *i.e.*, a failure to recognize its gravity.

It has always been, and still is, my contention that every case of acute appendicitis seen early should have prompt surgical attention—operation, provided, of course, that no absolute general contraindication to operation is present, such as pneumonia or uncompensated heart lesion. There is no one who can say which case of acute appendicitis may progress to recovery and which go on to abscess formation or general peritonitis and death. This has been proved so often that we have no right to postpone operation in any case. It is true that a certain number of cases of acute appendicitis will recover spontaneously under proper non-operative treatment, only to have subsequent attacks. It is equally true that some unoperated cases will die. Could we but differentiate the two classes clinically, our line of procedure would be easy to establish, but, as has already been stated, such a differentiation is impossible. The only safe and proper course, therefore, is to resort to prompt operation when a case of acute appendicitis is seen early. The reason for referring all cases of appendicitis at once to the surgeon has been stated by no one better than by our well-known internist, Dr. M. H. Fussell, who speaks as follows: "I thoroughly believe that at least three-fourths of the cases of appendicitis would recover if not operated upon, but I know there are no symptoms that will tell when a case is approaching the danger line until it is extremely dangerous either to interfere or to wait."

The results justify such a statement. My mortality in acute appendicitis seen early, when the inflammation has been confined to the appendix, has been very small. I believe it

to be but little if any greater than that which is incident to an opening of the abdominal cavity whether a lesion be present or not. In 100 consecutive cases of this nature in 1910, from January 1 to December 31 inclusive, the mortality was nil. Surely such a result (and like ones are being obtained by many operators) justifies itself and puts beyond a doubt the fact that immediate operation is the only proper method of treatment to adopt in early appendicitis.

The third reason for our mortality arises from our failure to recognize and act upon this proved fact in every instance. Delay in operation is the most important causative factor in the mortality of acute appendicitis. The reasons for this are so well known and evident that I need not mention them. If the disease is attacked sufficiently early, the destructive and inflammatory processes are more likely to be limited to the appendix itself, and easily removed. When operation is delayed the infectious organisms have time to penetrate or extend beyond the walls of the appendix, enter the peritoneal cavity, and give rise to the grave conditions accompanying a peritonitis either diffusing or localizing. Could these cases be seen, diagnosed, and *early* sent to the operating table, acute appendicitis would be almost robbed of its dangers and become in the hands of competent surgeons one of the least formidable of abdominal diseases.

The fourth great cause for our mortality in acute appendicitis is the incorrect treatment in cases in which, for some reason or other, the disease has been allowed to progress beyond the confines of the appendix and we have to deal with an acute appendicitis complicated by a more or less severe inflammatory lesion of the peritoneum.

The treatment of the appendicitis becomes then not a question of the lesion in that organ, since this is entirely overshadowed by the secondary conditions to which it has given rise.

A correct understanding of the problem of peritonitis may be facilitated by the recognition of the fact that all cases of peritonitis belong, as Federmann so well states, to one of two

great groups—the progressing and the localizing. The former is that in which the tendency of the process is to rapidly spread until it has involved most or all of the peritoneal surface. The localizing type is that in which the process tends to the formation of a localized peritonitis or a localized abscess. The latter is peculiarly apt to occur in connection with appendicitis. We know, for instance, that all cases of peritonitis of the upper abdomen due to acute perforation of viscera are of the progressing type, whereas many cases of peritonitis following appendicitis are not.

But at the outset of any peritonitis, within the first 24 to 40 hours, it has been shown that the process is unconfined, that is to say, lying free between the coils of the intestine. The formation of a limiting wall of fibrin occurs only at a later stage.

Experience also has proved that any peritonitis at this stage is, with few exceptions, amenable to prompt surgical treatment. The results after operation, with modern post-operative treatment are excellent. Indeed the mortality in my hands has been lower than that of any other form of peritonitis with which I have had to deal, unless it be a strictly localized pelvic peritonitis from disease of the adnexa.

In the five years ending with 1909 I operated upon 63 cases of diffuse peritonitis within 40 hours after onset, with but one death in the series. Since then, in 42 consecutive cases of appendiceal peritonitis operated upon at the German Hospital within 40 hours of the onset of the peritonitis, I have had one death, making in all 105 cases with two deaths, mortality 1.9 per cent. While I feel that this is a low death-rate when the desperate character of the disease is taken into consideration, yet it is noteworthy that an extension of the time limit for immediate operation has been accompanied by a rise in mortality. This expresses a fact which I have definitely determined from my own experience, namely, that the mortality rises with amazing rapidity if diffuse peritonitis of whatever origin, when present for more than 40 hours, is treated by immediate operation. It is, no doubt, difficult to

say exactly when an appendicitis passes over into a peritonitis. Our guide must be an exacerbation of pain and tenderness in the right iliac fossa, followed by extension of tenderness to adjacent areas. In fulminating appendicitis it may be taken for granted that the peritonitis has taken its origin very shortly after the onset of the disease itself. I dread early perforations near the base of the appendix which give rise to a rapidly diffusing and severe form of peritonitis. In view of the importance which we place upon the duration of the peritonitis itself, it is necessary to hold clearly in mind that this time may be very different from the duration of the disease. In some cases when a temporizing policy has been adopted, a low grade appendicitis may smoulder for several days or longer before it lights up a diffusing process within the general cavity. The 40-hour limit also is somewhat arbitrary as demarcating the early period of relative safety in immediate operation. One case will be found almost overwhelmingly septic, while in another the march of the peritonitis and the increase in severity of systemic symptoms may be slow. This, however, in general may be taken as the period within which experience has shown that in practically all cases operation may be done and should be done in full expectation of success. I would not feel content if I did not qualify this statement by saying that occasionally in cases of even this short duration there will be found one who exhibits extreme prostration, with capillary stasis perhaps amounting to cyanosis, with a low leucocytosis or none at all, in short with all general and local symptoms pointing to a virulent septic process and low bodily resistance. It is not proper to operate upon such a patient. Mere anæsthesia may tip the scale against him. That these cases are not numerous can be seen from the figures which I have given above and the determination of the pros and cons of operation in such a case should be left entirely to the surgeon, preferably one of large experience in abdominal work. I cannot too strongly insist that these are refinements to be considered only by experts in this class of work, and affect in no way my general position in respect to the necessity for

operation in appendicitis. It deals only with the determination of the most favorable moment for operation, not with the advisability of operative treatment. I am thus explicit because it has been my misfortune recently to be placed in a false light before the public by reportorial garbling of technical statements of this sort which were not intended for the laity and are indeed impossible for them to comprehend in their true light.

It is a matter of agreement amongst surgeons, I believe, that early cases of appendiceal peritonitis, with the possible exception just mentioned, should be promptly operated upon.

When we come to consider an appendiceal peritonitis of more than 40 hours' duration, a different problem confronts us. While it has been the experience of all surgeons that early cases of peritonitis as a rule recover, such, unfortunately, have not been the results in peritonitis of a longer duration. Indeed, peritonitis, diffuse or general, has so far been the one great failure in abdominal surgery. Several conditions must be met under this head.

There may be found a peritonitis of the localizing or second form which frankly is making progress towards or has already reached the stage of local peritonitis or localized abscess. The condition of the patient in such an instance as to temperature, pulse and leucocytosis and general appearance always indicates that the organism is successfully combating the toxins resulting from the peritoneal infection. The temperature is but fairly high, 100° to 102° , the pulse strong though at times somewhat accelerated. The leucocyte count is always high and in most favorable cases over 20,000.

In such an instance immediate operation is indicated unless localization and subsidence of the general symptoms have been rapid, marked, and unmistakable. In the latter condition slight further delay would give the surgeon a still more favorable condition for operation. When improvement has reached a stand-still, operation should be done at once.

Again, we may encounter a peritonitis which, by the general condition of the patient and its favorable course, if it may

be so called, is evidently of a localizing type but does not as yet show the distinct signs of local abscess. In these cases we have two factors to guide us—the patient's general condition and the signs of an abdominal mass, even though not of a distinct local abscess. If the patient's condition be good, temperature, pulse, and high leucocytosis as indicative of high resisting power, operation is indicated if we have in addition some signs of a more localized process than is shown by the symptoms only of a diffuse peritonitis, that is to say, if in addition to general abdominal rigidity and tenderness localized in the right lower abdominal quadrant, we have in this area any portion which on careful examination gives the signs of an abdominal mass, however diffuse and indefinite.

When, again, in a localizing peritonitis the local signs are favorable but the general condition of the patient not good, our best course is to delay operation until the latter improves, treating the patient meanwhile under the methods later to be described.

The progressing form of peritonitis presents an entirely different clinical picture. We have in this form of the process also, two clinical aspects, *i.e.*, that one in which the patient's condition and resistance seem satisfactory, and that in which the reverse is true.

Concerning the treatment of this form of peritonitis,—one peculiar to appendiceal and occasionally other forms of pelvic peritonitis,—there has been a wide difference of opinion. We have stated that it is advisable to operate upon practically all cases of less than 40 hours' duration, and have indicated those cases of localizing peritonitis in which immediate operation seems the best form of procedure.

In progressing peritonitis with no signs of the limitation of the process, when the case is seen later than the first 40 hours delay is usually the best policy. This does not apply to other than appendiceal or pelvic peritonitis—in perforation of the upper abdominal viscera into the general abdominal cavity such a lapse of time practically always has brought the case to a hopeless condition.

Particularly must delay be insisted upon in those cases in which the patient's condition is evidently desperate. There can be no doubt that many such cases of appendicitis have been lost as a consequence of hasty operation. Those that will not improve upon proper treatment during delay and progress to an unfavorable termination do so even more quickly when hastily operated upon.

The question arises when to consider the condition sufficiently localized for operation. Delay until there is absolutely a sharply defined and outlined abscess is not necessary. The patient's general as well as the local condition must be our guide. Operation should be postponed until the temperature and pulse strike an equable level, the leucocytosis is consistently high,—showing good resistance to toxæmia,—and peristalsis is known to be re-established as evidenced by free passage of flatus. Then if we are able to discover the signs of a deep-seated mass or resistance in the right iliac fossa, operation will disclose as a rule a limited peritoneal inflammation.

Finally, when we have the symptoms of a diffusing peritonitis following appendicitis, the decision whether or not to operate must always depend upon the patient's general condition and upon a careful study of the case. It can be taken for granted, however, that when we have the classical symptoms of such a form of diffusing peritonitis,—rapid running pulses, abdominal distention, cyanosis, and the facies Hippocratica,—operation will be almost inevitably fatal and delay may save the patient.

A fact of importance in the consideration of localized collections of pus within the peritoneum is the possibility of leakage into the general peritoneal cavity from the wall of a previously well-localized abscess. The general or diffuse peritonitis which results from this occurrence is often of a particularly virulent type, and in many instances has a most rapid onset, occurring with great suddenness when the symptoms previously have been entirely favorable. The avoidance of this complication is possible only by prompt operation.

To this mode of treatment there could be but two objec-

tions. The first and most easily set aside is that from the theoretical point of view. It has been repeatedly stated that it is best to operate upon every case of peritonitis of the acute variety as soon as possible. No one indeed is more positive in the opinion that every case of acute appendicitis *per se* should be operated upon immediately than I am. But when a peritonitis has set in it becomes in reality a different disease. Appendicitis confined to the appendix is one thing—peritonitis following an appendicitis offers us an entirely different problem.

The statement is often made that a peritonitis is but a form of abscess and that it has been the universal experience that the best treatment for abscess or local suppuration is prompt evacuation and drainage. Pus within the peritoneum, when not seen early and when not sharply localized, differs somewhat from abscess or pus formation in every other portion of the body. Here our experience has often been that the evacuation, even by means of a small incision or puncture, of the enclosed pus is often followed by the rapid diffusion of the toxins throughout the body and the death of the patient.

Buxton and Torrey, on the basis of animal experimentation, have concluded that the sudden so-called shock so often rapidly fatal after operations in fulminant peritonitis may be due to the explosive destruction of the bacteria by the immune substances of the body serum and liberation of their toxic contents into the circulation in large quantities. In other words, the too sudden destruction of virulent material within the peritoneal cavity may have even graver results than their activity while living.

From the practical point of view we can estimate the value of any one method of treatment only by the results. Personally, while I am cognizant of the great strides in post-operative treatment which have been made within the past few years, I am convinced that the more favorable results have been largely due to the selection of cases at the proper time for operation, and their proper pre-operative as well as post-operative treatment.

In the treatment of peritonitis both before and after operation, I have followed largely the method brought into prominence by Ochsner, with the addition of the Murphy method of enteroclysis.

When I see a patient suffering from a peritonitis as a result of appendicitis, the matter first to be considered is operation. If it be decided to postpone this, then the patient is treated in a way which we believe most often tends to conserve his strength and to bring about localization of the peritonitis.

One of the most important causes of the mortality in appendicitis, even among those who are believers in operation, is faulty pre-operative treatment. This is the true field of medical treatment in this disease, and I am certain that the procedures in common use among practitioners are responsible for a goodly percentage of deaths. It is a wellnigh universal custom to administer a purge in the early stage, and if recovery is not prompt to continue more or less drastic purging in the belief that it will favorably influence the disease. I must own that years ago I advocated this method, but I have long since been convinced that it not only does no good but does positive harm in many cases. The physician sees so many cases of colic or enteritis which respond readily to a simple purge that a false analogy has been drawn in respect to its efficacy in appendicitis. Except in those milder cases of catarrhal appendicitis which are only a part of an enteritis or colitis, it is difficult to see any great value in emptying the contents of the bowel, but it is easy to see that in the severe cases, to set up active peristalsis may mean to precipitate a perforation, to inhibit the formation of defensive adhesions, and to spread infective material throughout the peritoneal cavity. In the initial stage, before the diagnosis is readily made between simple colic and appendicitis and before the advent of local pain indicates that the inflammation has reached the peritoneal covering, it is inadmissible to give a rapidly acting purge, such as castor-oil or a saline. After the pain is localized and Nature is endeavoring by stiffening the surrounding muscles

to secure rest for the inflamed member, it is irrational to nullify her efforts from within, and every surgeon who has watched this point has observed that in general those cases that have been purged in this stage are likely to be more severe. If it is desired to move the bowels, enemata should be employed, but given gently, for a forced enema can be as objectionable as a purge. Quiet for the inflamed focus should be furthered by withholding all food and liquid by mouth, and all in this connection must mean all. An ice-bag over the right iliac fossa will cause the patient to lie more quietly in one position, will relieve the pain, and discourage too many examinations. The prevalent idea that it has any specific influence in abating the disease should be abandoned. It is wise to raise the head of the bed or better place the patient in a sitting posture in order to encourage the gravitation of fluid exudates or extravasations into the pelvis. Fluid for the body should be supplied by the rectal instillation of saline solution in intermittent or continuous form.

No morphia should be used, as the pain is rarely too great to be endured, and by its use the patient and physician are too often lulled into a false sense of security until peritonitis is too firmly established for any method of cure. An exception may be made to this rule when operation has been decided upon and the patient is suffering to an unusual degree from nervousness or pain. Then $\frac{1}{16}$ gr. to $\frac{1}{20}$ gr. morphia may be given and repeated once if necessary. If a little tact be used it is surprising how seldom anodynes are needed. Extreme degrees of suffering are not common in appendicitis.

Finally, all cases should be treated in the above manner, whether the medical attendant believes them to be serious or not. There is no way of differentiating the case that will get well from the one that will not. If equal care be used in all cases, the surgeon will rarely be requested to act in the capacity of Lord High Executioner upon patients moribund with peritonitis, and deaths in appendicitis will become rare.

Lavage to control vomiting and not medicine such as small doses of calomel, or calomel combined with cocaine, oxalate

of cerium or small doses of carbolic acid or dilute hydrocyanic acid, etc., any or all of which are not only useless but likely to aggravate and make the irritable stomach still more irritable. Medicines in this disease are out of place. If anything in medicine has been clearly proven, it is that appendicitis is a surgical disease, in fact the medical professor or internist, so called, should not be permitted to teach students the treatment of this disease unless he do so along the lines indicated in this paper.

The patient is given absolutely nothing by mouth until peristalsis is established; for it is a well-known fact that the smallest amount of food or even water introduced into the stomach gives rise to peristalsis, and peristalsis, however slight, must tend to prevent localization of the peritonitis. It is sufficient for the patient's comfort to keep the mouth moistened with a cloth. The patient's bodily strength is kept up by the use of continuous saline enteroclysis, continued as long as it is well borne, and at times interrupted for longer or shorter periods. I have found this to be of greater value than the use of saline enemata at stated intervals, even when they contain supposedly more highly nutritious substances in solution. The false, erroneous, absurd idea that patients with acute abdominal inflammation must be given nourishment by mouth has long since been disproven.

Continuous enteroclysis has been most largely used as a method of post-operative treatment, but I have found it of equal value in peritonitis prior to operation.

When vomiting occurs, it can be controlled by prompt and thorough lavage, repeated as often as may be necessary. This is a most essential part of the treatment, for putrefying food within the stomach or regurgitated into it gives rise to virulent toxins and ptomaines, having a profound depressant action upon the bodily economy as a whole. Lavage is also to be employed when there is *great* distention of the stomach, hiccough, or nausea, or the spitting up of small amounts of dark fluid. These as well as frank vomiting are the evidences of retention and regurgitation of putrefying material in the

alimentary tract, and call for the prompt use of the stomach tube until the condition is relieved. This also is most useful as a preventive of a possible acute gastric dilatation which I believe to be infectious or toxic.

In addition the use of the ice-bags externally allays pain and seems in a degree to inhibit active peristalsis.

Opium and opiates I use most sparingly in the treatment of peritonitis. While opium and its derivatives stop peristalsis, they do so in a manner which soon produces complete paralytic ileus, with its accompanying obstruction, retention of toxins, etc. The relief of pain also is not to be considered as a prime factor in comparison to saving the patient's life. Moreover, this complete dulling of pain produced by morphine is most deceptive and often makes it impossible to determine correctly the stage of the disease under treatment or its progress. When the patient is in extreme pain or so restless that he cannot be controlled by other means, which is rarely the case, I employ morphine in doses of $\frac{1}{20}$ to $\frac{1}{16}$ hypodermically, repeated once if necessary.

The operative technic which I employ in cases of peritonitis associated with appendicitis is that of any other peritonitis. The use of protective pads is most important to prevent the spread of infection. The appendix is always removed except when a circumscribed abscess is present and its removal would be attended by too great danger of diffusing septic material. Lavage of the peritoneum I consider not only useless but harmful. It is my practice to remove the pus by the gentlest means and with special care not to disturb the coating of plastic and protective lymph which is often found on the bowel serosa. It is not this lymph which causes subsequent adhesions. These can most often be attributed to rough handling of the bowel during operation, or the trauma of pads or instruments.

Drainage should be by tube whenever possible. I have found split rubber tubes with a gauze wick serviceable, if the tube be sufficiently rigid to preserve its calibre. Cigarette drains are useful only when there is but little need for drain-

age. I would call your attention to the importance of pelvic drainage in cases of peritonitis. By this I mean drainage by means of a glass tube introduced into the pelvis through the incision, or through a stab wound over the pelvis. When, after operation, the patient is placed in the sitting posture, all fluid in the abdominal cavity will gravitate to the pelvic area, and it is this even more than the operative field that we want to drain.

After operation the patient is placed in the sitting position, and the treatment is practically as before operation.

In conclusion I would say that if there is one fact in the field of medicine which has been demonstrated conclusively, it is that the rational treatment of acute appendicitis is in operation, early and immediate if possible; late, postponed, or absolutely contraindicated only by the presence of other conditions which may be complications of the disease itself or entirely independent of it, mere coincidences which render the performance of any operation too hazardous. Advice other than this no man has a right to give.

The following table illustrates the results obtained by this method of treatment during the year 1910 in the German Hospital and in the Children's Hospital of the Mary J. Drexel Home.

		Deaths	Mortality
Number of cases of acute appendicitis.....	315	9	2.85
German Hospital	235	7	2.97
Mary J. Drexel Home (Children).....	80	2	2.5
Number of cases acute appendicitis, no peritonitis..	100	0	0
German Hospital	80		
Mary J. Drexel Home	20		
Number of cases appendicitis with peritonitis.....	215	9	4.13
German Hospital	155	7	4.51
Mary J. Drexel Home	60	2	3.33
Number of cases with diffuse peritonitis.....	74	6	8.1
Number of cases with localized peritonitis.....	66	1	1.51
Number of cases with serous fluid	39	0	0.00
Number of cases indeterminate at operation.....	16	1	6.25

CHRONIC APPENDICITIS.

A CRITICAL STUDY OF POST-OPERATIVE END RESULTS.

BY E. MacD. STANTON, M.D.,

OF SCHENECTADY, N. Y.

CHRONIC appendicitis is a disease ideally suited for surgical treatment. The operative technic is settled, simple, and safe. The postoperative convalescence is rapid and easy, no important organs or physiological functions are interfered with or disturbed, and the cure in real cases is absolute.

Kehr has, however, very aptly said that a living patient who has received no permanent benefit from an operation is a living, talking, unforgettable advertisement of failure, and any considerable proportion of such cases must soon condemn an operative procedure, even though the average results obtained are considerably better than those reached by other means. That the end results in cases operated upon for supposed chronic appendicitis have not thus far been altogether satisfactory, is attested by the fact that in almost every community there are more or less numerous patients who have had their appendices removed, with no improvement in their symptoms. This is partly accounted for by the fact that chronic appendicitis has been the especially selected playground of the amateur surgeon, but there is abundant evidence that a large proportion of the uncured patients have left the operating tables of surgeons whose standing is unquestionable.

That in the future these results can be considerably improved admits of no doubt. Such improvement must come largely through careful study of the successes and failures of the past, and the investigation upon which this paper is based was undertaken with the idea that the knowledge so gained might enable us to eliminate a certain proportion of the unsatisfactory late results. This study has consisted of a review of the literature on the subject, together with a critical analysis

of the end results attained by my associate, Dr. C. G. McMullen, and myself in 100 cases operated upon under the clinical diagnosis of chronic appendicitis.

DEFINITION.

Chronic appendicitis has usually been considered under the three following heads:

1. Recurrent appendicitis, in which the patient suffers from well-defined acute attacks with intervals relatively symptomless, the operation being performed to prevent subsequent attacks.

2. Relapsing appendicitis, in which the patient has suffered from one or more well-defined attacks, never having recovered normal health in the intervals.

3. Chronic appendicitis, the term including those chronic symptom-producing conditions of the appendix, in which definite attacks of acute appendicitis have either never occurred or at least do not constitute an easily recognizable part of the clinical picture. Patients in this class seek relief, not from the acute attacks but from the more or less serious gastrointestinal symptoms, pain, or other discomforts due to an abnormal condition of the appendix.

The older literature on chronic appendicitis refers almost entirely to interval operations in the recurrent type, but within recent years the term has been more and more limited to the third class of cases, and it is to this latter type of appendicular disease that the present study has been chiefly directed.

PATHOLOGY.

Considerable confusion exists in the literature concerning the pathological changes found in cases of chronic appendicitis. Most writers who have based their opinions chiefly on microscopical findings without reference to the clinical symptoms have dwelt largely upon certain so-called catarrhal changes in the appendix, but the writer, in a pathological study of over 2000 appendices, has been unable to correlate the finer micro-

scopical changes with the clinical symptoms in the chronic cases. In my own experience the essential pathological changes have been studied satisfactorily only at the operating table, where all conditions which may interrupt the free drainage of the appendix are open to observation. Almost without exception, symptom-producing appendices are associated with anatomical conditions interfering directly with the free drainage of the appendix, and as a rule the more permanent the occlusion the more constant or frequent the clinical symptoms. Conversely, so-called catarrhal appendices without demonstrable obstruction have seldom produced clinical symptoms referable to the appendix.

Actual obstructions may be due to cicatricial strictures within the appendix itself, or to fecal concretions or other solid bodies, or to malpositions of the appendix caused either by a short mesentery or by adhesions the result of developmental or previous inflammatory conditions.

SYMPTOMS.

Probably in no other well-recognized surgical condition occurring within the abdomen does the literature show such utter confusion regarding the symptomatology. Following the paper on "Appendicitis Larvata" published by Ewald in 1899, almost every conceivable abdominal ache or pain and every imaginable variety of indigestion have been ascribed to chronic appendicitis or appendicular dyspepsia. Even as late as 1910 we have Moynihan's article on appendix dyspepsia so vaguely written, that, as Bowlby has aptly pointed out, one might infer from it that all forms of indigestion are caused by the appendix. All of this reminds one of the confusion which existed a few years ago concerning the symptomatology of gastric and duodenal ulcer, and it is to be hoped that in a few years we may have a type picture of chronic appendicitis at least approaching in clearness of outline that of duodenal ulcer or gall-stones. The recently published study of Graham and Guthrie goes far toward clearing up some of the confusion,

and their findings correspond quite closely with our experience in our cured cases.

In studying the symptoms of appendicular dyspepsia I have made use of two groups of cases: the chronic appendix cases, 51 in number, in whom the symptoms of indigestion were cured by removing the appendix; and a control group of 33 patients operated upon for acute appendicitis, but who after operation found themselves cured of a long-standing chronic dyspepsia. The character of the indigestion was the same in both groups, and although individual patients may differ in their description of the symptoms, the type picture of the essential features is apparently quite constant.

Many of those operated upon for acute appendicitis state that the final attack began like their old attacks of indigestion, but that instead of soon letting up the pains grew steadily worse, and that before long the telltale right inguinal pain was added to the acute indigestion and then followed the diagnosis of acute appendicitis. In studying the symptoms of appendicular dyspepsia we must, therefore, bear constantly in mind the early symptoms of acute appendicitis.

Previous Attacks of Acute Appendicitis.—Forty-seven out of 64 or 73 per cent. of our cured cases give a history of having had at some previous date acute abdominal illnesses, usually referred to as acute indigestion, gastritis, or bilious attacks, but on close analysis presenting the classical picture of an acute appendicular illness, namely, rather severe sudden epigastric, umbilical, or general abdominal pain, soon accompanied by nausea or vomiting, and later followed by pain or soreness in the right inguinal region, and a period of partial or complete incapacity for work.

Indigestion.—Of our 64 cured cases, in 51 chronic indigestion was the chief cause of complaint, and of the remaining 13, 11 gave a history of having had attacks of acute indigestion, the symptoms of which were interpreted as being really those of acute appendicitis. Thus in only two cured cases were the symptoms solely those of right inguinal pain, and in one of these patients the right tube and ovary were also removed.

Pain.—Pain is the most constant symptom of the acute attack, but the first pain is only in rare instances referred to the right inguinal region. The primary pain is almost always located in the epigastrium or mid-abdomen, and it is only after some hours or until definite inflammatory changes are well advanced in the appendix, that the patient complains of pain in the right lower quadrant. Similarly in our cured cases of chronic appendicitis, the pain has been almost constantly referred to as epigastric or mid-abdominal rather than right inguinal. On the other hand, nearly all the patients not benefited by operation complained of right inguinal pain as one of their chief symptoms.

Graham and Guthrie state that, given attacks of dyspepsia accompanied by epigastric pain with radiation to or about the umbilicus or lower abdomen, we must hold first and clearly to appendicular disturbance, and this statement agrees perfectly with our experience. We may call this pain a pylorospasm, or we may account for it as best suits our fancy, but it is apparently analogous to the early pain of the acute appendix attack, and its presence in real cases of chronic appendicitis is so constant that its absence in the history of a suspected case should lead to a grave doubt as to the accuracy of the diagnosis. Such attacks of epigastric or mid-abdominal pain or distress were present in over 96 per cent. of our cured cases.

Epigastric or mid-abdominal pain is also a prominent symptom in a number of other abdominal diseases, but a carefully analyzed history will allow of a differentiation in most cases.

In gastric and duodenal ulcer we have a clean-cut regularity in the symptoms not observable in appendicular dyspepsia. In ulcer, before secondary complications have intervened, the intervals between the attacks are free from symptoms, and during the attack the pain comes on at a regular interval after each meal. Food gives temporary relief and alkalis are similarly effectual. Later, as complications intervene, much of this regularity is lost, but the early history is always attainable and the onset of complications is usually accompanied by evidences of food retention.

In gall-bladder disease we have the sudden onset and almost equally sudden relief, with the characteristic radiation of the pain, or in the absence of real pain we may have the sudden attacks of gaseous pressure relieved by belching, slight vomiting, or regurgitation. The patient as a rule notices no definite relation to food intake, the periods of disability are usually short, and the intervals are, as a rule, free from symptoms except as regards hyperacidity in some cases.

In chronic constipation the distress or pain is of a diffuse character, with areas of special intensity corresponding to points along the colon. Increase of pain or distress is directly referable to the degree of constipation, and the trouble is temporarily relieved by catharsis.

In enteroptosis the pain varies greatly in individual cases, bears a definite relation to fatigue, and gas is associated with the characteristic physical type and neurasthenic tendencies.

In appendix dyspepsia the first pain of an attack may come on without warning or may follow an indiscretion in diet, but during the subsequent period of disability, food intake is regularly associated with an increase of distress or pain. The pain is irregular as to time of onset and may appear any time, from a few minutes to an hour or more after eating, and may be manifested only as a peculiar epigastric distress, or attacks of quite severe abdominal pain may be followed by days or weeks in which the patient is afraid to eat because each meal is liable to be followed by a peculiar, tenacious distress of such a nature as to convince both the patient and the examining physician that there is something definitely wrong at some point in the intestinal canal.

Nausea.—Next to the pain and epigastric distress, nausea has been the most frequent symptom in our cured cases. As the pain increases in severity, nausea becomes a prominent symptom, and with painful attacks approaching in intensity the pain of acute appendicitis, nausea and vomiting become the rule. While actual vomiting is confined largely to the more severe painful attacks, nausea seems to be far more common than in gastric ulcer or gall-stones; nausea is the rule

during the height of the attacks, and frequently is the most constant and distressing symptom complained of by the patient. Ochsner has called attention to the fact that this symptom is especially frequent in cases where the appendix contains a large fecal concretion.

Constipation.—Most writers have spoken of constipation as one of the chief symptoms of chronic appendicitis, but in our cured cases constipation has not been more prevalent than in the ordinary run of office patients, and removal of the appendix has had no constant effect upon this condition. As will be noted later, a large group of uncured patients with pain in the right lower quadrant suffered from chronic constipation, and neither the pain nor the constipation was benefited by removing the appendix. Several patients who sometimes had spells of sudden diarrhœa, following soon after the onset of their painful attacks, were cured of the diarrhœa after removal of their appendices, a fact previously noted by Ewald and others.

Gas.—In our earlier records, gas and distress are often used without special differentiation, but we have come to realize that in chronic appendicitis the distress usually bears no particular relation to gas, and although discomfort from gas makes up part of the general picture, it is a far more characteristic feature of our uncured than of our cured patients.

Appetite.—The appetite often fails during the height of the attack, but for the most part our histories in the cured cases record the fact that the appetite is good but the patient is often afraid to eat because of the subsequent distress.

Taking the 64 cured patients as a group, we are at once struck by the fact that 62 complained of attacks of epigastric or mid-abdominal pain or distress. Forty-seven stated that they had one or more attacks in which the primary pain and nausea were also accompanied by pain or soreness in the right lower quadrant, a fact which aided materially in the diagnosis, but even in these patients the subjective symptoms directly referable to the region of the appendix constitute but a minor part of the total discomfort. On the other hand, our uncured

patients almost without exception complained of pain in the right lower quadrant as their chief symptom.

It is altogether probable that the symptoms of so-called appendiceal indigestion are caused by the same abnormal condition which is the predominating factor at the onset of the acute attack, namely, an obstruction interfering with the free drainage of the appendix, and that as long as the lesion remains a mechanical one the pain or discomfort is referred to the mid-abdominal region. On the other hand, it is a well-known fact that, with the onset of active inflammatory changes in the appendix, we have pain subjectively referred to the region of the appendix. In those who escape the acute inflammatory attacks, the subjective symptoms may be entirely referred to the epigastrium or mid-abdominal region, but, in the majority of patients, occasional attacks will probably lead to active inflammatory changes in the appendix and an accompanying pain or soreness in the right lower quadrant.

Gall-stones.—Previously undiagnosed gall-stones were found in three men and one woman operated upon for chronic appendicitis. Cholecystectomy in addition to the appendectomy resulted in a cure in each case. All of these patients had definitely diseased appendices, but when the histories were again taken after the operation, it was found that in each, the gall-bladder had undoubtedly been responsible for its share of the symptoms. This error in diagnosis is of little practical importance, provided the gall-bladder is routinely examined each time the abdomen is opened.

UNCURED CASES.—Our uncured cases, 36 in number, may be divided into several well-defined groups, a study of which will, I believe, illustrate some of the errors frequently made by both the surgeon and general practitioner.

Movable Cæcum Group.—This is the largest group and comprises 16 cases, all of whom were characterized at operation by a long, movable cæcum without any very definite changes in the appendix. Although before operation the enteroptosis had not been clearly recognized, a re-examination after operation shows that the majority of them belong to the

physical type so commonly associated with Glénard's disease. None of these patients was permanently benefited by the operation, although nearly all of them were apparently much benefited for a few weeks or months, a fact probably accounted for by the enforced rest and careful diet incident to the operation and convalescence.

Viewed as a group, the histories differ strikingly from those of the cured cases. Previous attacks with symptoms corresponding to acute appendicitis are mentioned in only two histories, while in none of the patients in this group was epigastric or mid-abdominal pain a prominent feature. On the other hand, pain in the right lower quadrant was the ever-present symptom which induced these patients to seek surgical relief. Chronic constipation is usually associated with the pain, and gas is a far more noticeable symptom than in the cured cases. Fatigue is often given as a cause of increased pain.

During the past two years Wilms, Wiemann, and Stierlin, in Germany, and Cheinesse, in France, have each published papers dealing with the movable cæcum in its relation to the diagnosis of chronic appendicitis, and Wilms has devised a most ingenious method for fixing the cæcum, by means of which he claims to have had excellent results. Stierlin, in an exhaustive paper on the subject of movable cæcum, has recently reported the end results in 43 cases operated by Wilms, with 75 per cent. of complete cures, a number of the cured cases having previously had their appendices removed without benefit. In the older literature on this subject, we find Edebohls, who believed that 80 or more per cent. of movable kidneys were associated with symptoms of chronic appendicitis. Also the paper of Blake, who shows that a movable cæcum may be the cause of real appendix trouble.

Lane has recently called attention to certain adhesion-like bands, which may be present in these cases and cause symptoms by obstructing the ileum close to the cæcum. The real importance of Lane's kink, which has recently attracted considerable attention, has not yet been determined, but the possibility of its presence should always be borne in mind.

No especial difficulty should be encountered in properly diagnosing this class of cases, provided one bears in mind the absence of any previous well defined appendix attacks, together with the absence of epigastric pain or distress as a prominent symptom, and gives due consideration to the chronic constipation and the objective evidences of enteroptosis and dilated cæcum.

Kidney Lesions.—Three men in our series not cured by appendectomy subsequently developed typical attacks of renal colic, and it is possible that renal obstruction may have been a cause of symptoms in several of the uncured women. A careful history, aided by the X-ray and the cystoscope in all suspicious cases, should make a differential diagnosis between kidney and appendix lesions possible in most instances. It is a fact, however, that in the past a very large proportion of patients suffering from intermittent hydronephrosis have had their appendices removed without benefit, and it is only by the most conscientious use of all diagnostic aids at our command that we can hope to escape similar errors in the future.

Psoas Spasm.—Two patients not cured by appendectomy apparently suffer from some lesion involving the psoas muscle, the trouble being associated with painful contractures of the right psoas which can be readily palpated in each case. In these patients the pain is chiefly related to muscular exertion, and flexion and adduction of the right thigh gives partial relief. Operation was undertaken with the idea that an adherent appendix might be the cause of the trouble, but no lesion of the appendix was found in either case.

Hysteria.—Two uncured patients developed typical symptoms of hysteria soon after operation. If we bear constantly in mind the possibility of this error very few mistakes should be made. It must of course be borne in mind that appendicitis may be the existing cause of hysteria.

Tuberculosis of Mesenteric Lymph-nodes.—Tuberculous mesenteric lymph-nodes were found in one case in which the appendectomy did no good, but the positive diagnosis made possible by the laparotomy was of sufficient value to justify

the operation, and under very rigid hygienic treatment, this patient has remained in good health since the operation.

Miscellaneous.—In twelve patients the symptoms still complained of are of such indefinite nature as to leave the diagnosis in doubt. Appendectomy undoubtedly benefited several of these patients, but they still consider themselves far from cured.

SUMMARY.

1. The majority of patients suffering from chronic appendicitis give a history of having had one or more attacks of acute abdominal illness, with a sequence of symptoms recognizable as those of an acute appendix attack, namely, sudden severe abdominal pain, usually beginning in the epigastrium or mid-abdomen, accompanied by nausea and vomiting and followed by a period of pain and tenderness in the right lower quadrant.

2. In our experience appendiceal dyspepsia has been characterized by symptoms strikingly analogous to the earliest symptoms of acute appendicitis, namely, attacks of epigastric or mid-abdominal pain or distress only rarely accompanied by subjective symptoms referable to the region of the appendix. During those attacks the pain or distress is nearly always increased by food intake.

3. Pain confined chiefly to the right lower quadrant and not associated with attacks of epigastric pain and nausea is seldom due to the appendix, and before making a diagnosis of chronic appendicitis in these cases every other possible condition should be excluded.

4. The majority of our failures have been in patients complaining of right inguinal pain associated with chronic constipation. At operation these patients have presented an unusually long or dilated cæcum, usually accompanied by other evidences of enteroptosis. In the future a certain proportion of these patients may be cured by some such operation as that advocated by Wilms, but appendectomy alone does not cure.

5. Unless the diagnosis is absolutely certain, the gall-bladder, stomach, and right kidney should be explored, and the possibility of a Lane's kink excluded in all cases operated upon for chronic appendicitis.

BIBLIOGRAPHY.

- Graham and Guthrie: The Dyspeptic Type of Chronic Appendicitis, Jour. Amer. Med. Assoc., 1910, liv, 960-963.
- Moynihan, B. G. A.: Remarks on Appendix Dyspepsia, Brit. Med. Jour., Jan. 29, 1910.
- Bowlby, A. A.: Brit. Med. Jour., 1910, i, 349.
- MacCarty: Classification of Appendicitis and the Relation of Chronic Appendicitis to Obliteration of Lumen, Jour. Amer. Med. Assoc., 1910, lv, 488-491.
- Stanton, E. MacD.: The Sequence of the Pathologic Changes in Appendicitis, Jour. Amer. Med. Assoc., 1905, June 19.
- Smith, R. R.: The Diagnosis of Chronic Appendicitis, Detroit Med. Jour., Mar., 1909.
- Myers, J. S.: Secondary Gastric Manifestations in Chronic Appendicitis, Interstate Med. Jour., 1910, xvii, No. 8.
- Morrison, Wm. H.: Chronic Appendicitis, Amer. Med., 1907, n. s. ii., 86-91.
- Paterson, H. J.: Appendicular Gastralgia or the Appendix as a Cause of Gastric Symptoms, Prac. Royal Soc. of Med., April, 1910; also in Lancet, 1910.
- Blake, J. A.: Malposition of Appendix as Cause of Functional Dist. of Intestine, ANN. OF SURG., Sept., 1905.
- Cheinnisse, L.: Phantom Appendicitis and Pseudo-appendicitis, Semaine Medicale, Paris, 1910, xxx, 1-12.
- Handley, W. Sampson: Invalidism in Women Due to Chronic Appendicitis, Clin. Jour., March 25, 1908.
- Ewald: Appendicitis Larvata, Arch. f. klin. Chir., vol. 1x, p. 80, 1899-1900.
- Mann, A. T.: Mistakes in Diagnosis of Appendicitis, Northwestern Lancet, May 15, 1907.
- Kohn, A. D.: Appendicitis Larvata, Surg., Gyn. and Obst., Oct., 1906.
- Richelot, L. G.: Chronic Appendicitis, Bull. de l'Académie de Méd., Paris, 1908, lxxxii, 517-536.
- Dieulafoy: Unnecessary Operations for Appendicitis, Bull. de l'Académie de Méd., Paris, 1906, lxx, No. 22.
- Capogrossi, A.: Chronic Appendicitis, Policlinico, Rome, 1909, Nos. 49 and 50.
- Hansman: Berliner klin. Wochenschr., Feb. 13, 1905.
- Steward, F. J.: Biliary Attacks Cured after Operation for Acute Appendicitis, Practitioner, London, 1910, lxxxiv, 789-796.
- McKinnon, A. J.: Surgical Suggestions for the Treatment of Chronic Appendicitis, Med. Herald, 1910, U. S., xxix, 62-65.

- Duverge, J.: Gog. Hebdl. d. sc. Med. de Bordeaux, 1909, xxx, 208-210.
 Allan, J.: The Treatment of Relapsing, Recurrent and Chronic Appendicitis, Practitioner, London, 1909, lxxxii, 405.
 Murphy: Keen's Surgery, p. 759, iv.
 Williams, E. M.: A Review of Cases of Chronic Appendicitis, South. Med. Jour., 1909, ii, 713-717.
 Carver, E. M.: Operations for Appendicitis and Symptoms that may Result from Appendicitis, Especially Chronic, Med. Press and Arc., 1908, U. S., lxxxvi, 503.

Special References to Movable Cæcum.

- Wilms: Das Cæcum mobile als Ursache mancher Fälle von sog. chronischer Appendicitis, Deutsche med. Wochenschr., 1908, Nr. 41. Fixation des Cæcum mobile bei Fällen von sog. chronischer Appendicitis, Zentralbl. f. Chir., 1908, Nr. 37.
 Klose: Klinische und anatomische Fragestellung über das Cæcum mobile, Beiträge z. klin. Chir., Bd. 63, Heft 3.
 Klemm: Über die chronische anfallfreie Appendicitis, Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1906, Bd. 16, S. 580.
 Haberer: Beitr. zur Appendixfrage, mit besonderer Berücksichtigung von Dauerresultaten, Archiv f. Chir., Bd. 76.
 Stierlin: Das Cæcum mobile als Ursache mancher Fälle sog. chronischer appendicitis und die Erfolge der Cöcopexie, Deutsche. Zeitsch. f. Chir., 1910, cvi, 407-476.
 Wandel: Über Volvulus des Cæcum und Colon ascendens., Mitt. a. d. Grenzgeb. d. Med. u. Chir., Bd. 11, S. 39.
 Curschmann: Topogr. klin. Studien, Deutsch. Archiv f. klin. Med., 1894, Bd. 53.
 Klose: Die habituelle Torsion des mobilen Cæcum. Ein typisches Krankheitsbild., Münch. med. Wochenschr., 15, ii, 1910, Nr. 7.
 Graser: Über angeborene abnorme Lagerungen des Darmkanales und ihre Bedeutung für die praktische Chirurgie, Festschrift für Rosenthal, 1906.
 Stierlin: Beitr. z. röntgenogr. Untersuchung der Colon-Peristaltik, Zeitschr. f. klin. Med., 1910, Bd. 70, 5 u. 6.
 Anschütz: Über den Verlauf des Ileus bei Darmcarcunio und les lokalen Meteorismus des Cæcums bei tiefsitzendem Dickdarmverschl., Arch. f. klin. Chir., 1902, Bd. 68.
 Robinson: Les dimensions du cæcum et la typhlectasie, Acad. d. sciences, séance du 7 mars, 1910; Sem. Med. Nr. 11, 16 mars, 1910.
 Fischler: Die Typhlatonie (Dilatatio cæci) als selbständiges Krankheitsbild. Mitt. a. d. Grenzgebiet d. Med. u. Chir., Bd. 20, Heft 4.
 Singer: Pseudo-appendicitis und Ileocæcalschmerz., Wien und Leipzig, 1905.
 Glénard: Les ptoses viscérales, Paris, 1899.
 Schmidt, A.: Die Funktionsprüfung des Darmes, Wiesbaden, 1909; Verhandl. d. Congr. f. innere Med., 1908.

- Lohrlich, H.: Die Ursachen der chronischen habituellen Obstipation in Lichte systematischer Ausnutzungsversuche, D. Arch. f. klin. Med., 1879.
- Hertz, A. F.: Lectures of the Passage of Food through Alimentary Channel, 1905.
- Nowak u. Bräutigam: Experiment. Beiträge zur klin. Bedeutung der Darmgase., Münchn. med. Wochenschr., 1900.
- Simon, O.: Die chron. Obstipation Ergebnisse d. inneren Med. u. Kinderheilk., 1910, Bd. 5.
- Wilms: Über die Sensibilität und Schmerzempfindung der Bauchorgane., Deutsche Zeitschr. f. Chir., Bd. 100.
- Ritter: Zur Frage der Sensibilität der Bauchorgane., Zentralbl. f. Chir., 1908, Nr. 20.
- Lenander: Beobachtungen über die Sensibilität in der Bauchhöhle., Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1902, Bd. 10.
- Wilms: Zur Pathogenese der Kolikschmerzen., Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1906, Bd. 16.
- Propping: Zur Frage der Sensibilität der Bauchhöhle., Beitr. z. klin. Chir., Bd. 63, Heft 3.
- Wilms: Der Ileus, Deutsche Chirurgie.
- Holzknicht: Die normale Colonperistaltik, Münchn. med. Wochenschrift, Nr. 47, 23, xi, 1909.
- Hochenegg: Über die Indikation zur Appendektomie beim Ileocæcalschmerz., Wiener klin. Wochenschr., 1905, Nr. 51.

SOME OBSERVATIONS UPON THE SURGERY OF THE URETER.*

WITH A BRIEF REPORT OF THIRTY-ONE CASES.

BY GEORGE EMERSON BREWER, M.D.,

OF NEW YORK,

Surgeon to Roosevelt Hospital.

THE development of surgery of the ureter was made possible by the introduction of the cystoscope and ureteral catheter. Before the employment of these aids to diagnosis, pathological conditions of the ureter were rarely recognized, and their symptoms generally attributed to lesions of the kidney or bladder.

While the first crude instruments devised to obtain knowledge by direct inspection of the bladder mucosa and ureteral orifices served to awaken the interest of the profession in ureteral disease, it was not until 1891, when the catheterizing cystoscopes of Nitze and Casper were introduced, that a systematic study of the lesions of the ureter was undertaken.

During the past twenty years much has been added to our knowledge of these conditions, and many operative procedures have been devised and practised for their relief.

While the number of diseased conditions of the ureter requiring relief by surgical operation is limited, and while few surgeons have acquired a large experience in these procedures, still at the present time it may be stated, that most surgeons are encountering an increasing number of these operations; and, for this reason it seemed to the writer, that the present meeting of the society might with profit be devoted to a discussion of the various procedures employed in treating some of the more common conditions, which would be mutually helpful.

* Read before the New York Surgical Society, March 22, 1911.

With a view to opening this discussion, I will give a brief review of the methods I have employed and the results obtained in the few cases of ureteral disease that have fallen under my personal care, in the hope that I may glean from your discussion facts which will enable me in the future to avoid some of my earlier mistakes.

In reviewing my case histories, I find that I have records of 31 patients presenting symptoms of ureteral lesions, in which operations were undertaken or seriously considered. The actual number of operations performed by me for the relief of the ureteral lesions or their sequelæ was 34. This does not include a number of operations performed without relief by other surgeons before the patients came under my care. Several of these patients presented more than one lesion.

The cases may be classified as follows: congenital malformations, 2; traumatic rupture, 1; ureteral fistulæ, 4; strictures due to aberrant arteries, 2; strictures due to inflammatory exudates, 3; strictures due to faulty implantation into renal pelvis, 1; ureteral calculus, 17; symptoms and signs of ureteral calculus, no stone found at operation, 3.

CONGENITAL MALFORMATIONS.

CASE I.—The patient was a young man, twenty-eight years of age, who complained of two attacks of right-sided colic lasting several hours; blood and albumin in the urine, tenderness in the right renal region.

X-rays showed small, clearly defined shadow just below right kidney. On operation the following conditions were revealed: (1) aberrant renal artery leading to upper pole, rendering delivery of the kidney extremely difficult; (2) a thin-walled perirenal cyst, which was ruptured during the manipulations necessary to effect delivery of the kidney; (3) double renal pelvis and ureter, which, however, fused about four inches below the kidney; (4) hydronephrosis of upper pelvis and ureter, lower pelvis and ureter normal.

Upper pelvis opened and calices explored, with negative result. Small hard body palpated in upper ureter just above its junction with lower tube. On exploration this was found to be

a soft calculus, which was removed. Ureter catheterized and found to be patent. Ureteral wound closed, kidney replaced, and abdominal wound partly closed by layer suture and drained. The operation was exceedingly difficult, long, and accompanied by considerable shock.

Patient complained of severe constant pain for fourteen days, accompanied by an irregular temperature, progressive asthenia, and signs of infection of the kidney. It was finally decided to reopen the wound for exploration. A large œdematous kidney was found which was the seat of numerous septic infarcts. Nephrectomy, followed by prompt recovery.

CASE II.—A boy, aged twenty years, was referred to the writer by Dr. W. H. Murray of Plainfield, suffering from a urinary fistula in the right inguinal region. Several months before this he had been operated upon for supposed acute appendicitis. The operation was a difficult one and associated with considerable hemorrhage, necessitating the use of numerous clamps, some of which were left temporarily in the wound. After rather a stormy convalescence, urine was observed to flow from the wound in considerable quantity. One or two subsequent efforts were made to close the fistula but without result. On examination, a scar of the previous operations was found in the right inguinal region, in the centre of which was the opening of the fistulous tract, which on probing was found to lead backward and toward the median line. Here on careful palpation there could be felt a mass which seemed to be a rather small, malformed ectopic kidney.

Cystoscopy and ureteral catheterization by Dr. Osgood demonstrated normal urine from the left ureter. The ureteral catheter could only be passed a short distance into the right ureter, and from this no urine could be obtained.

Under ether anæsthesia an incision was made to the outer side of the original scar dividing the several layers of muscle until the peritoneum was reached. This was slowly reflected from the iliac fossa until the outer edge of the misplaced kidney could be felt and seen. As a dense mass of adhesions now seemed to bind the skin and various intraperitoneal structures to the kidney, further attempts to expose it by this route seemed unwise, as the location of the vessels entering the organ could not be determined. The peritoneal cavity was next opened by a median

incision and the free intestines packed off with large masses of handkerchief gauze. It was then found that the cæcum and several adherent loops of small intestine apparently surrounded the fistulous tract, which communicated with the upper part of the ureter. A median incision was next made in the parietal peritoneum covering the great vessels, and this was gently reflected from the median line until the kidney was finally exposed. Several large vessels were seen passing from the aorta and right iliac vessels to a cleft on the anterior surface of the kidney. These were secured and divided. After this, with one hand in the external wound and the other in the median incision, the kidney was with great difficulty separated from the overlying adherent intestines and removed. The parietal peritoneum was then replaced and sutured, both wounds were united by layer suture, and the fistulous tract packed with formalin gauze.

His convalescence was prompt and uneventful.

INJURY.

CASE III.—My case of traumatic rupture of the ureter occurred in a young man who had been crushed in a railway accident, resulting in fracture of the pelvis. When first brought to the hospital, he was catheterized and clear urine withdrawn. Later expressing a desire to urinate, he passed a small amount of dark red fluid which contained numerous blood-cells. Just before operation he was again catheterized, and clear urine again withdrawn.

On operation there was found a bilateral fracture of the pelvic brim, with laceration of the internal iliac vessels and a complete rupture of the ureter on the right side. As the patient was moribund, an attempt was made only to arrest the hemorrhage by gauze packing. He died shortly after leaving the table.

The case is of interest only in illustrating the cause of his intermittent hæmaturia.

FISTULÆ.

CASE IV.—Abdominal hysterectomy by a colleague. Accidental division of the right ureter. An attempt subsequently made by the same surgeon to implant proximal portion into bladder. As this was unsuccessful, a second operation succeeded in implanting it into upper portion of vagina. Abdominal sinus

healed but patient suffered greatly from irritation of vulva and thighs, from constant contact with urine.

After consultation it was decided to advise nephrectomy, which was successful with complete restoration to health.

CASE V.—Hysterectomy by the writer for carcinoma which surrounded right lower ureter. Ureter implanted into vault of vagina.

Recovery from hysterectomy, followed by ascending infection of right kidney. Chills, fever, delirium, and great prostration. Complete recovery after nephrectomy. Patient died the following year from recurrence.

CASE VI.—The ureteral fistula following operation for acute appendicitis in iliac kidney reported above under Congenital Malformations (Case II).

CASE VII.—Operation by colleague for pelvic infection on right side. This was followed by an abundant flow of urine from iliac wound, which had been drained. Patient in rather poor condition from prolonged sepsis. Advised no operation, but measures to insure free drainage. Sinus finally closed by granulation, the patient making a complete recovery.

STRICTURE.

CASE VIII.—Female, aged twenty-five years. For two years has experienced attacks of severe right-sided pain, with swelling in the flank, often accompanied by nausea and vomiting. No fever, no hæmaturia, no frequency in urination. X-rays negative. At operation, kidney pelvis was found moderately distended, with the ureter implanted at its upper extremity and acutely kinked. A large diamond shaped section of the posterior wall of the pelvis was removed and the wound closed with a fine catgut continuous suture, reinforced by a layer of the fibrous capsule of the kidney, which was stripped from the organ and sutured over the wound in the pelvis. She made a rapid and satisfactory convalescence. No leakage. Primary union of the wound. Patient well one year later.

CASE IX.—An unmarried female, aged twenty-nine years. Suffered for twelve years from recurrent attacks of severe left-sided renal colic, with swelling of the flank. Duration of the attacks from a few hours to four or five days. Patient greatly emaciated by prolonged suffering. Renal tumor distinctly felt,

which was as large as an egg-plant and exquisitely tender. No fever, moderate hæmaturia on one or two occasions.

On operation, kidney found displaced downward. Renal pelvis greatly distended. Dense vascular band extending from lower pole of the kidney to aorta (and aberrant renal artery). This band caused a constriction of the dilated pelvis, forming an hour-glass tumor with distortion of the ureteral implantation and obstruction of the tube. The band was divided between two ligatures, and the fluid contents of the pelvis evacuated by moderate compression. The kidney was pushed up into its normal position, which served to straighten the ureter, and the organ firmly anchored in place. The wound healed kindly, but the patient was never free from pain, and several weeks later had a severe attack, with the development of a large renal tumor. Nephrectomy was followed by complete relief. Examination of the specimen showed great thickening of the ureter at the point of previous pressure.

CASE X.—A man, thirty-four years of age, suffered for several months from right-sided attacks of typical renal colic. When examined during an attack there was tenderness and an abnormal fullness in the right flank. X-ray negative. Cystoscopy and ureteral catheterization revealed no calculus.

On exploring the kidney by a lumbar incision a dense vascular band (aberrant artery) was found passing from the lower pole of kidney, compressing the ureter. This was divided between two ligatures and the compressed ureter freed. The kidney was fixed in its normal position, and the wound closed. The convalescence was somewhat delayed by severe pain and moderate fever occurring several days after operation, probably due to a mild attack of septic infarcts. This subsided promptly, and the patient left the hospital well one month from the date of the operation. Six months later patient free from recurrence.

CASE XI.—Female, aged twenty-six years. Pain in right inguinal region for several months. Appendix removed without relief. Pain paroxysmal, radiating from kidney to groin. Microscopic blood in urine. Cystoscoped. Ureteral orifices normal. Right ureteral catheter meets obstruction near kidney pelvis. X-rays show faint shadow just above posterior spine. Ureter explored by longitudinal incision in flank. Marked angulation caused by inflammatory band. This was removed, the ureter

opened, and bougie passed upward to kidney and downward to bladder. No further obstruction encountered. Wounds closed. Primary healing. Patient reported well five years later.

CASE XII.—Male, aged forty years. History of operation for vesical calculus twenty years ago. For past four years has suffered from left-sided colic, which has become more frequent during past three months. Pain very severe, radiating to groin. Cystoscoped, urine from left kidney blood stained, and from right clear. X-rays showed round shadow near transverse process of fourth lumbar vertebra, which corresponded to point of greatest tenderness to pressure. Ureter and kidney explored, no stone found; only inflammatory thickening around pelvis of kidney, and upper part of ureter. Ureter freed from surrounding adhesions. Wound closed with fine chromic sutures. Lumbar incision united by layer suture. Recovery.

CASE XIII.—Male, forty-two years of age. Several attacks of left-sided colic with soreness and general discomfort in the flank and inguinal region most of the time. Has felt feverish at times. No blood or pus in the urine.

X-ray gave indefinite shadow over region of lower ureter near bladder. Cystoscopy revealed patent right ureter with abundant flow of urine. Left orifice pouting. No efflux after indigo carmine for one hour. Catheter could not be introduced.

An incision eight inches in length was made parallel to Poupart's ligament from a point two inches above the anterior superior spinous process. The muscles were divided until the retroperitoneal tissue was reached. The peritoneum was retracted toward the median line and a thickened and dilated ureter exposed, which was followed downward over the brim of the pelvis. When near the bladder dense adhesions were encountered, surrounding the lower inch of the canal and constricting it to a thin, dense, fibrous cord. With extreme difficulty these adhesions were separated from the impervious extremity of the ureter until its junction with the bladder was recognized. As the hemorrhage was troublesome, the wound was many times irrigated with hot salt solution and packed with gauze.

During manipulations undertaken to palpate the vesical wall, with the hope of finding a stone in the intramural portion of the ureter, the small fibrous extremity was torn from the bladder. A drop of pus slowly oozed from the minute opening in the

proximal portion of the tube, which was quickly clamped. As there was no efflux from the bladder stump, the ureter was brought outside of the wound, the small fibrous extremity cut off, and a large amount of foul-smelling pus evacuated. The bladder was next emptied, and a sound introduced and pressed firmly against the left posterior wall. A small incision was made into the viscus at this point, and the free extremity of the ureter drawn into the bladder and sutured by the Van Hook method. The wound was then very carefully disinfected and closed by layer suture; a large cigarette drain remaining in the lower angle, which extended to the retroperitoneal space in the bottom of the pelvis. No reaction followed the operation. The entire wound healed primarily without leakage of urine.

CALCULUS CASES.

CASE XIV.—Boy of fourteen years entered Roosevelt Hospital suffering from pain over the appendix region and marked tenderness at McBurney's point. Indefinite history of fever with previous attacks.

Diagnosis of chronic appendicitis. Normal appendix removed. Re-entered hospital several months later with large hydronephrosis. Kidney removed. Ureteral sound passed into ureter and arrested near bladder. Several months later patient again entered hospital with impacted oblong calculus in posterior urethra. This was removed by perineal section, with complete and permanent relief.

CASE XV.—Young negro entered Roosevelt Hospital suffering agonizing pain near McBurney's point. No fever, no muscular rigidity except during height of attack. History of many similar attacks during past six months. Right kidney had been explored in another hospital.

On the advice of one of the older surgeons, I removed a normal appendix with complete relief of symptoms for several weeks. The attacks, however, returned, and after a number of examinations I detected a few red blood-cells in a specimen of urine passed immediately after a particularly severe attack. No X-ray or cystoscopy available at that period.

Believing that we had to do with a calculus somewhere in the right urinary tract, the right kidney and upper third of the ureter were exposed by a long lumbar incision. The kidney appeared normal, but a small calculus was detected lodged in

the upper part of the ureter just below the pelvis. The ureter was opened by a longitudinal cut, the stone removed, and the ureteral incision closed by three or four fine chromic catgut sutures. He made an uninterrupted recovery.

CASE XVI.—Male, aged thirty-four years. Suffered from right-sided renal colic for twenty-six years. Hæmaturia and pyuria present. Right kidney explored for stone, with negative result, six months before admission. X-ray examination showed dark shadow near spine of ischium. Ureteral orifice everted, catheter arrested in lower ureter. Operation, eight inch incision parallel to Poupart's ligament; external oblique aponeurosis split; internal oblique and transversalis muscles divided transversely. Peritoneum separated from iliac fascia and right side of pelvis. Stone felt near ischial spine. Ureter much thickened and dilated above calculus, which was pushed upward to brim of pelvis. Longitudinal incision in ureter, irregular mulberry stone removed. Ureteral wound closed by five chromic catgut sutures, muscles united by plain gut. Cigarette drain to retroperitoneal space. Skin united with silkworm gut. Primary union. No leakage of urine.

CASE XVII.—Male, aged forty-nine years. Suffered from right-sided colic and frequent micturition for two or three years. X-ray showed oblong shadow near vesical end of right ureter. Cystoscopic examination showed eversion and œdema of right ureteral orifice. Ureter exposed by same incision as in previous case. Calculus felt at junction of bladder. Ureter opened near pelvic brim for exploration with metal probe. Attempt to push calculus upward to ureteral wound unsuccessful. Second opening over stone, which was easily removed. Both ureteral openings sutured with fine chromic catgut, the lowermost with considerable difficulty. Wound closed. Primary healing.

CASE XVIII.—Female, aged forty-three years. Suffered from attacks of left-sided pain for sixteen years. Has had left ovary and tube removed, kidney and ureter explored, and ventral hernia operated upon without relief. Blood and pus in urine. X-ray examination showed small distinct shadow at vesical end of ureter. Bladder opened above pubis. Probe introduced into left ureter. Stone felt one-half inch above meatus. Ureteral orifice enlarged and stone removed by forceps. Suprapubic wound closed. Frequent catheterization. Primary union and complete recovery.

CASE XIX.—Female, aged forty years. Left-sided colic for eighteen years, becoming more frequent and severe for last eighteen months. Slight hæmaturia and frequency. Cystoscopic examination. Ureteral orifice puffy. Ureteral catheter meets slight obstruction at seven inches, which is, however, easily overcome, and passed to pelvis of kidney. X-rays show distinct shadow near pelvic brim. Ureter explored in usual manner. Stone felt just below brim, easily pushed upward to dilated portion of ureter, and removed through longitudinal incision. Wounds closed in usual manner. Complete healing under first dressing.

CASE XX.—Male, forty years of age. Several attacks of severe left-sided colic radiating from kidney to groin and testicle. Duration three weeks. No frequency, no fever, slight hæmaturia. X-ray shows angulated shadow over upper third of left ureter. Ureteral catheter obstructed at this point. Ureter exposed in loin by lumbar incision, longitudinal opening through which calculus was removed. Ureteral wound sutured with fine chromic catgut. Abdominal wound closed in usual manner. Primary healing.

CASE XXI.—The patient whose history was presented as Case I under Congenital Malformations.

CASE XXII.—Male, fifty-five years of age. Exceedingly obese, suffered from severe left-sided abdominal pain, with nausea, vomiting, and great prostration. Bowels constipated, and no effort on the part of the attending physicians to produce a movement had been successful. The abdomen became distended, and his condition became critical. I saw him in consultation in the country, where cystoscopy and radiography were out of the question. The diagnosis rested between renal colic and intestinal obstruction. The size of the patient and his extreme tenderness and restlessness prevented our obtaining any reliable data from the physical examination.

Under ether anæsthesia, the abdomen was explored with negative result, but a large renal tumor was appreciated by the examining hand within the peritoneal cavity. The abdominal wound was closed and an enormous hydronephritic kidney exposed by a lumbar incision. This was opened and drained through the cortex, with complete relief of symptoms. The sinus persisted for several weeks, with more or less pain at intervals over the lower ureter. Finally after a particularly severe

pain, the discomfort entirely disappeared and a small calculus was passed the next day. After this the urinary fistula quickly closed, and the man regained his usual health.

CASE XXIII.—Female, twenty-two years of age. For two years patient has had attacks of severe right-sided pain shooting along the course of the ureter to the pelvis. Occasional vomiting. Thinks she has noticed red urine. Occasional attacks milder in character and accompanied by moderate fever. Physical examination practically negative. X-rays show small definite shadow near right kidney. Cystoscopy: both ureteral orifices moderately oedematous. Both ureters catheterized. Only small amount of purulent urine from right, abundant flow from left. Indigo carmine appeared in twelve minutes.

Kidney and upper ureter exposed by lumbar incision. Small, round, and irregular calculus in upper ureter. This was removed through the usual longitudinal ureteral incision, which was subsequently closed with fine chromic catgut sutures. Primary union. Complete recovery.

CASE XXIV.—Male, aged thirty-five years. Severe attacks of right-sided renal colic for several months. Intermittent attacks of fever and frequent micturition. Record fails to give urinary analysis or result of physical examination. X-rays show small shadow near bladder. Cystoscopy: left ureteral orifice normal; right, typical "golf hole" appearance. Abundant flow of normal urine from left catheter. Right ureter could not be catheterized, but small stream of thick pus was seen to exude from meatus.

Lower ureter exposed by long iliac incision, followed down to point near its junction with bladder. At this point the calculus was encountered and removed by a longitudinal incision. Ureteral wound united with fine chromic catgut sutures. Muscles and skin separately sutured. Cigarette drain to retroperitoneal space. Primary healing.

CASE XXV.—Male, sixty years of age. Fifteen years ago noticed soreness in left groin, which increased in severity, became stabbing in character, and radiated to left testicle. These attacks continued until three years ago, when he passed several small fragments of stone. Temporary relief followed but was succeeded by more pain; tenderness over kidney and ureter, frequency of micturition, rectal tenesmus, and the passage of mucus with the stool. X-rays show small shadow near ureteral implantation into bladder. Cystoscopy: abundant flow of normal urine

from right ureteral orifice, only small amount of pus from left. Right ureteral orifice normal; left pouting; intravesical portion of ureter swollen and projecting into bladder. Catheter easily passed to right kidney, but could not be introduced into left.

Under ether anæsthesia left lower ureter exposed by long inguinal incision. Ureter found dilated with retained urine. Ureter followed to bladder. Considerable induration at point of implantation, but no stone could be detected. Incision extended transversely across bladder region just above pubis. Bladder opened and stone easily palpated in intramural portion of the bladder. Incision made through bladder mucosa into ureter, and stone removed. Bladder wall united; abdominal incision sutured in usual manner, perineal drainage of bladder. Primary union. No leakage from bladder. Patient has since passed small fragments of stone with only slight discomfort.

CASE XXVI.—Female, fifty-five years of age. History of several attacks of right-sided renal colic, followed by a severe attack, with fever, chills, and some sweating. When first seen by the writer there was easily palpated a large, tender, kidney-shaped mass in the right flank. As the patient was passing the summer in the country, no cystoscopy or X-ray examination was made. The patient was immediately prepared for operation.

On exposing the kidney by a long lumbar incision, its pelvis was seen to be distended with pus, the parenchyma highly congested and œdematous. A large opening was made through the cortex, and about 500 c.c. of thick, foul-smelling pus evacuated. About four inches below the kidney the ureter was found to be completely occluded by a large oval calculus. This was removed by a longitudinal incision in the walls of the ureter, which was then probed and found to be patent. No effort was made to suture the ureteral wound on account of the acute infection. The parietal wound was partly closed with adequate drainage, and the patient made a slow but complete recovery.

In addition to the thirteen cases in which stone was found and removed from the ureter, the writer has observed a large number of others in which stones in the ureter, suspected by the symptoms, were demonstrated by the X-rays, cystoscopy, or ureteral catheterization, and were subsequently passed. I will refer to but three of these.

CASE XXVII.—A man of forty-eight years, who had a small stone arrested in the lower part of the left ureter. There was a history of three or four attacks of severe left-sided colic during the preceding eighteen months. When he entered the hospital there was moderate paroxysmal pain, tenderness one inch above the external inguinal ring, and some frequency of urination. Urine contained a moderate amount of blood. X-ray examination showed small oblong stone in lower segment of left ureter. I advised against operation for the reason that at that time I had had no experience in operations on the lower ureter, and regard the procedure as more dangerous than expectant treatment. He drank copiously of Poland water and expelled his stone at the end of four or five days.

CASE XXVIII.—A man, thirty years of age, entered the hospital suffering from severe right-sided renal colic. Cystoscopic examination revealed a stone arrested in the right ureteral orifice. While being prepared for operation the stone was expelled, with complete disappearance of symptoms.

CASE XXIX.—The history of this case, occurring as it did in a member of our house staff, is reported somewhat in detail, because it furnishes an absolutely accurate statement of the sensations experienced by an individual suffering from an arrested calculus in the lower ureter, together with the signs observed and immediately recorded by a colleague who was in constant attendance.

Previous to initial symptoms there had been no indication whatever of renal or vesical trouble. However, in the three or four months preceding attack there had been occasional twinges of pain in right lower quadrant. They were not severe, occupied but the fraction of a second, and were not considered seriously.

On February 3, about 11.30 A.M., patient experienced pain on right side of glans which lasted about one-half hour. It was definitely localized just behind corona, and might be well described as a sensation produced by the moderate pressure of a pencil point against the mucous membrane. So localized was this pain that the patient referred it to some slight traumatism, but on examination found nothing to account for it. About one hour later (at least one and a half hours after this pain disappeared), several drops of bright red blood were noticed at the end of micturition. Following this there was moderate vesical tenesmus

and about half-hour frequency, both largely due to alarm and the desire to see if there would be further hemorrhage.

About one-half hour after the first appearance of blood patient voided six ounces of claret-colored urine and, within the next hour, twelve ounces of urine similarly colored. The bladder was then irrigated and the return was slightly blood tinged. A sound was also passed in the effort to locate a vesical calculus. Within fifteen minutes after this instrument, pain of a colicky character began. Its seat was in the lower pelvis, and there was but very short radiation up the right side. The right testicle became slightly tender and there was moderate irritation at the meatus. These symptoms became rapidly more severe and there was definite radiation upward and downward along the distribution of the genitocrural nerve. The testicle became much more tender, and irritation at the meatus marked. There was pronounced rigidity, mainly on the right side, and vomiting. These symptoms, somewhat relieved by opiates, continued until the following morning. The urine continued bloody until about 4 P.M., sixteen hours after blood was first seen.

During the next day the pain persisted, but had lost its acute character and involved the whole lower right quadrant. Testicle still sore, but irritation at meatus completely disappeared. On the second night the pain again became acute and continued so until the morning, when it practically ceased, leaving only a feeling of soreness on the affected side. Patient felt perfectly well, was out over two hours, and had two sets of X-ray plates taken.

The following (third) night pain began again. It was very acute, radiated downward as before, but higher than previously, the right lumbar region was exceedingly tender. There was moderate soreness in the right testicle and slight irritation at the meatus. Large quantities of water were taken and there was frequency, with perfectly clear urine. This acute attack persisted until noon of the following day, when great relief was obtained by frequent change of position and the sitting posture. Patient retired about 11 P.M. with practically no pain, and slept soundly until 3 A.M., when he was awakened by exceedingly acute pain extending from high in the right lumbar region to the testicle and marked irritation at the meatus. Clear urine was immediately passed. This attack lasted about one hour, when the pain suddenly disappeared. About six ounces of urine was then voided, which was of a dirty brown color and contained

numerous small clots, but no fresh blood. Patient slept comfortably and had no more pain until 11 o'clock the following day, when another attack began. The pain was now localized in the lower pelvis and there was no radiation. Soreness of the right testicle and irritation of the meatus were slight. Then the most severe pain yet experienced occurred and lasted about two hours, when there suddenly came a very acute paroxysm followed by a sensation as if a constriction had been released or as if something had given way. There was immediate cessation of all pain, and in a few minutes a small calculus was passed with about ten ounces of urine, dirty brown in color and containing small clots. No fresh blood was present. A slight soreness in the pelvis only remained for two days.

In all of these cases the stone was small, not over .5 centimetre in diameter. Yet in all three, the colic was as severe as any I have ever observed.

I now desire to record four mistakes in diagnosis, in which the ureter was exposed by the lumbar or iliac incision, opened and explored, but no stone found.

CASE XXX.—A man, twenty-eight years of age, suffered from intense left-sided renal colic at intervals for several weeks, with hæmaturia, frequent micturition, and tenderness in the left inguinal region. X-ray negative, except for a faint shadow near kidney. Cystoscopy showed left ureteral orifice everted and œdematous, with a long, worm-like blood-clot emerging. Catheter could not be introduced more than a few centimetres. The kidney and lumbar portion of the ureter were exposed, the kidney palpated, the ureter opened and explored with a metal probe. Slight resistance was encountered near its vesical extremity, but this was easily overcome, and a full sized instrument passed to bladder. Primary union of both wounds.

CASE XXXI.—Male, aged thirty-six years. Severe pain in left flank; vomiting, with tenderness over kidney. Hæmaturia. X-ray shadow faint and without well-defined edges near ischial spine. Cystoscoped. Left ureteral orifice everted, blood emerging; could not be catheterized. Ureter explored by abdominal incision, opened, and found to be patent. Bougie seen in bladder by cystoscopy. Wounds closed in usual manner.

CASE XXXII.—Male, aged forty-eight years. Mild pain

over lower left ureter on walking. No urinary symptoms, no vomiting, no pain, no tenderness over kidney. Tenderness in left inguinal region. Distinct shadow on X-ray plate in left half of pelvis. Ureter explored by usual incision; hard mass felt in contact with ureter. Ureter opened, probe passed easily to bladder and to pelvis of kidney. Peritoneal cavity opened. Calcified appendix epiploica of sigmoid adherent to parietal peritoneum over ureter. This was removed. Wounds closed. Primary healing.

CASE XXXIII.—Male, aged forty-five years. Admitted for operation for chronic appendicitis. X-rays showed small round shadow near transverse process of fourth lumbar vertebra on right side. Abdominal incision over appendix to retroperitoneal space. Ureter exposed, opened, and sounded, with negative result. Peritoneal cavity next opened and diseased appendix removed. All wounds closed in usual manner. Primary union.

In reviewing the above case histories, it will be seen that the majority of my mistakes in diagnosis were made in cases supposed to be calculus. There were six of these. In three, other lesions were found which were sufficient to account for the symptoms. In the remaining three no lesions were found to account for the symptoms, although an extra-ureteral calcareous body was found in one instance, which gave rise to the shadow in the X-ray plate, and in another there was reason to believe that a stone was present at the time of the examination, which passed before the ureter was opened. Of my three other mistakes in diagnosis, two were in mistaking a ureteral calculus for a lesion of the vermiform appendix, and one in mistaking a ureteral calculus for intestinal obstruction. In none of these cases did I have the aid of cystoscopy or radiography. Only one death occurred in the series, and that was the traumatic case which was moribund at the time of his admission, and in which nothing was done other than to check the hemorrhage by gauze packing.

Of the fifteen cases in which the ureter was exposed, opened, and subsequently sutured, all healed without infection and without leakage of urine. The same may be stated in regard to the two cases in which a ureteral calculus was removed through an opening in the bladder.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, held March 8, 1911.

The President, DR. ELLSWORTH ELIOT, JR., in the Chair.

TUMOR OF THE TONGUE OF UNCERTAIN CHARACTER.

DR. EDWARD M. FOOTE presented a man, 45 years old, who in January, 1901, had a rectal abscess which was incised and drained, and which healed slowly, necessitating three additional operations during the following three years. The condition finally healed about four years ago. About that time, the patient's mouth became tender, with swelling of the lips, cheeks, and gums. In December, 1909, portions of the lips and cheeks were cut away, and in July, 1910, the tongue was cauterized twice by Dr. Mayo, of Rochester. Although the patient never had any symptoms of syphilis, he had been given antisyphilitic treatment at different times in West Baden Springs, Ind., Hot Springs, Ark., and recently in New York City, without any curative effect. On December 9, 1910, a Wassermann test was negative, and no spirochætæ were found in the blood.

On November 9, 1910, a wedge-shaped piece was removed from the dorsum of the tongue, and another from its left margin. In spite of this, the tongue continued to increase in size, and on January 26, 1911, Dr. Foote amputated about one inch of it. The wound was sutured, and healed primarily. Sections of the tongue were submitted to microscopic examination to four pathologists, with the following result: Dr. James Ewing regarded the condition as a macroglossia from chronic myositis, with secondary plasma-cell infiltration of the tissues. Dr. John A. Fordyce said the condition might be a sarcoma, but he did not feel inclined to commit himself definitely to that diagnosis. Dr. D. Stuart Dodge Jessup thought it was possible to rule out carcinoma, sarcoma, and syphilis, and in the presence of giant-cells, tubercle tissue and bacilli, there was slight ground for the diagnosis of tuberculosis. The cells of the growth had the ap-

pearance of plasma cells, and for lack of a better name, the term plasmoma might be employed. Dr. F. M. Jeffries pronounced it a small, round-celled sarcoma. Dr. William B. Coley, who also examined the patient, said that from a clinical stand-point he thought syphilis and malignancy could be ruled out, and he considered the condition probably macroglossia of the chronic inflammatory type.

Since February 3, 1911, the patient had received fourteen injections of the mixed toxins (from 1 to 10 minims each) with moderate systemic reaction and slight checking of the growth of the tongue.

TRANSPLANTATION OF MALDESCENDED TESTIS, PERINEAL,
INTO THE SCROTUM; RESULT FOUR YEARS
AFTER OPERATION.

DR. WILLIAM B. COLEY showed a man, 29 years old, who was operated upon in April, 1907, for an inguinoperineal hernia, with the testis in the middle of the perineum. The testicle was transplanted into the scrotum, but a few months later it retracted into its original position in the perineum. In October, 1907, Dr. Coley again operated, this time suturing the testicle to the bottom of the scrotum. It had remained in perfect position ever since, and there had been no recurrence of the accompanying hernia.

The testicle was of absolutely normal size, and occupied a position in the scrotum quite as low as the other. In his paper on "The Treatment of the Undescended or Maldescended Testis," *ANNALS OF SURGERY*, September, 1908, he reported the result of operation in nine cases, and stated that he had observed six other cases of perineal ectopia which were not operated upon.

INOPERABLE SARCOMA OF THE SCAPULA IN AN INFANT
TWO MONTHS OLD SUCCESSFULLY TREATED WITH THE
MIXED TOXINS OF ERYSIPELAS AND BACILLUS PRO-
DIGIOSUS.

DR. WILLIAM B. COLEY presented a child who, when an infant two months old, was referred to him on June 20, 1910, by Dr. John F. Harrison of Stamford, Conn., as a case of inoperable, malignant tumor of the scapula. The family history was unimportant, with the exception that the mother had a hard tumor removed from the first joint of the big toe a year and a half ago; this, apparently, was not submitted to microscopical ex-

amination. At the birth of the child, labor was difficult, and Dr. Harrison stated that the left shoulder was strained. No swelling, however, appeared until two weeks after birth, when a small tumor was noticed in the midscapular region, apparently starting in the bone or periosteum. This grew rapidly, and examination on June 20, 1910, showed a tumor occupying almost the entire region of the left scapula, 3 by 3 inches in diameter, and projecting about three-quarters of an inch beyond the level of the surrounding parts. The tumor was firmly fixed to the scapula, and had about the consistence of an osteosarcoma. The skin over it was of a purplish hue, and was covered with dilated veins; no fluctuation was present, and there was no evidence of inflammatory trouble. The clinical diagnosis was so certain and the prognosis seemed so hopeless that a microscopic examination was not made. Dr. Coley's diagnosis was confirmed by Dr. Virgil P. Gibney, and treatment with the mixed toxins was immediately begun, the initial dose being one-tenth of a minim, which was gradually increased to one-half minim, which latter dose produced a temperature of 102° F.

At the end of two weeks' treatment there was unmistakable improvement, as shown by slight decrease in the size of the tumor and diminished vascularity. At the end of six weeks, the dose of the toxins could be increased to two minims. After three weeks' treatment, the patient was sent home, and the toxins had been continued up to the present time by the family physician, Dr. Harrison, at first three times a week, later twice a week, and during the past two or three months only once a week. The improvement evident at the end of the first two weeks of treatment had steadily continued, and in October the growth had decreased to one-fourth its original size, and two months later it had practically entirely disappeared.

The child was in perfect health at present, and no trace of the original growth could be detected. Movements of the arm were normal.

THE DE LORME-SCHUDE OPERATION FOR EMPYEMA: TWO CASES.

DR. OTTO G. T. KILIANI presented these cases in order to show the final results of the operation. In the first case, that of a girl 21 years old, the operation was done twelve years ago,

the patient having been operated on for empyema 21 months prior to that time, with a resulting fistula and discharge. Dr. Kiliani removed the fourth, fifth, sixth, seventh, and eighth ribs on the right side, and in spite of the fact that the lung on this side had been completely occluded for 21 months, it began to expand immediately when the pseudomembrane covering it was stripped off. At the time of the operation, the child was about nine years old. The operation resulted in complete healing of the old fistula, which had never reopened. With the exception of a marked scoliosis, the girl was now practically well.

Dr. Kiliani's second patient was a man, who had pneumonia in 1904 and who was operated on seven weeks later for empyema. Following this, a fistula developed which persisted for four years, and in December, 1908, he had a cavity with a capacity of 40 c.c. At that time three ribs were resected, and three months later the cavity had a capacity of eight ounces.

On March 27, 1909, Dr. Kiliani made a typical horseshoe incision, reopening the old scar, and resecting the fourth to the ninth ribs inclusive. The pleura was enormously thickened, and after stripping off the pseudomembrane, the lung expanded at once, in spite of the compression to which it had been subjected for four years.

This patient had remained free from any signs of a recurrence until a few days ago, when a slight fistula developed at the lower angle of the wound.

TUBERCULOSIS OF THE SKULL.

DR. KILIANI presented a young man, who, fourteen years ago, had two huge abscesses of the skull, which were operated on in Germany and which were supposed to be gummata. A year ago, at St. Luke's Hospital in New York, he was operated on for a bony abscess of the skull, and following this there was a fistulous opening which refused to heal.

Recently Dr. Kiliani trephined the skull over the site of the fistulous tract. The bone was much thickened, and tubercular granulations were found between the skull and the dura. The diagnosis in this case, the speaker said, rested between lues and tuberculosis. A Wassermann test had been made, with negative results. A microscopic examination of the soft parts did not show with certainty any evidences of tuberculosis.

LUNG ADHERENT TO SUBCUTANEOUS TISSUES.

DR. ROBERT T. MORRIS presented a woman upon whom he had recently operated for a sarcoma involving the seventh, eighth and ninth ribs. In this case, the intratracheal insufflation method of anæsthesia would have been desirable, but not having the apparatus at hand, Dr. Morris said he resorted to a method which he had used in certain cases of injury of the lung, namely, he simply allowed the lung to collapse while he was doing the resection of the ribs. When this was completed, and after sponging out the blood-clots and nearly closing the wound by suture, he pumped the air out of the pleural cavity and the lung then expanded.

The gap in the chest wall was now covered with only skin and the subcutaneous tissues; the lung had become adherent to the latter, and as the patient breathed, the skin moved back and forth with each respiration. No drainage was employed. There was very little cough. The patient had practically full lung function on that side.

DISLOCATION OF THE CARPAL SEMILUNAR.

DR. MORRIS presented a man who fell from a step-ladder, dislocating his left carpal semilunar bone in such a manner as to cause intense suffering for several days. A radiograph was taken, which showed the dislocated bone crowded down in front of the os magnum and unciform. Under anæsthesia, the bone could be replaced with slight pressure, but when this was released, it again immediately slipped out of place. It was again forced into its proper position, and kept there by a section of rubber tubing placed on each side of the carpus and held in place by bandages. When these were removed, after three weeks, it was found that the bone had again become displaced, but only to a slight extent. The patient had remained entirely free from pain, and the simple procedure in this case, Dr. Morris thought, had obviated the necessity of removing the bone. It might become necessary, at some time in the future, to break up the adhesions.

MYELOMA OF TENDON SHEATH.

DR. FRANK S. MATHEWS presented this case. The patient was a woman who had had a tumor of the distal phalanx of the first finger. It was very hard, and about the size of a hazel-

nut. A transverse incision was made across the palmar aspect of the finger, and through this the tumor could be readily shelled out. It had no connection with the skin or bone, but sprang from the flexor tendon sheath. Pathologically, it was giant-celled sarcoma, and illustrated the fact that these giant-celled tumors, of whatever origin, were practically always to be classed as non-malignant.

In connection with this case, Dr. Mathews said that about a year ago, while preparing his paper on "Myeloma of the Long Bones" (*ANNALS OF SURGERY*, Sept., 1910), he first learned of these tumors originating in the tendon sheaths. He looked up the subject, and found that Sutton, Adami, and others made no mention of tendon sheath giant-celled tumors, and in most of the pathological works they were referred to only as originating in the bones. At the meeting of this Society on November 9, 1910, Dr. William Darrach read a paper on "Tumors of the Hands and Fingers" in which he referred at some length to these tumors of tendon sheath origin, which he said had been described by certain French writers under the name of "myeloma" though realizing that they have no relation to bone marrow.

INTRAMEDULLARY GLIOSARCOMA OF THE CERVICAL CORD
(FIFTH, SIXTH, AND SEVENTH SEGMENTS); LAMINECTOMY AND REMOVAL OF THE TUMOR IN TWO STAGES;
RECOVERY.

DR. CHARLES A. ELSBERG presented a woman, 42 years old, who was referred to the surgical department of the Neurological Institute from the service of Dr. Joseph Fraenkel on January 12, 1909, with the following history: After a sore throat in the spring of 1907, she began to suffer with pain of a boring character in the back of the neck. The pain gradually extended to the shoulders and down the arms, and was followed by numbness in the right hand. For about two years these symptoms occurred in attacks, between the attacks the patient feeling well. In the summer of 1909 she first began to notice some awkwardness in the left arm, soon followed by considerable loss of power in that extremity, and later in the left leg. About this time, the pain in the upper extremities grew less marked. By the fall of 1909 the awkwardness had affected also the right upper and lower extremities, and the patient's

loss of power was so great that she had much difficulty in walking. Then followed a very rapid loss of power in the upper extremities, especially the left, and a recurrence of the pain in the back of the neck and shoulders. Soon the lower limbs became very weak and stiff.

The patient's general condition was good. She was well nourished; the special senses were normal; there was no difficulty in swallowing nor in urination or defecation. The pupils were of normal size and reacted well to light and accommodation. She had to be supported when she sat up in bed, and could walk only with the greatest difficulty when supported. The vertebral column, in the cervical and dorsal region, was held rigid, and there was marked tenderness on percussion over the spines of the fourth, fifth, and sixth cervical vertebræ. When the attempt was made to flex the neck on the chest, the patient had a feeling of constriction around the upper part of the chest.

The motor power in both upper extremities was much diminished, more so on the left than on the right side. When the patient attempted to move either extremity, there was very coarse ataxia, and she stated that she did not know the position of the limbs unless she looked at them. The left arm could barely be raised away from the body; all movements at the elbow were weak, and extension of the forearm was impossible. All of the muscles of the left arm and forearm reacted only slightly to the faradic current, and no contraction of the triceps could be obtained. There was marked atrophy of the muscles forming the thenar and hypothenar eminences on the left side, and of the triceps and infraspinatus. On the right side, similar changes to those on the left were present, but they were much less marked.

The motor power in the lower extremities was much diminished, especially on the left side. The knee-jerks were exaggerated, especially the left; there was double ankle clonus, Babinski, Oppenheim, all more marked on the left side. An X-ray examination failed to show any changes in the vertebral column. Fluid obtained by lumbar puncture was not under great pressure, and did not contain anything abnormal.

The patient was transferred to the surgical department by Dr. Fraenkel, with the diagnosis of tumor of the cord between the fourth and seventh cervical segments. A cervical pachy-

meningitis hypertrophica was also deemed possible, the latter diagnosis having been considered by Dr. Fraenkel because of the fact that the symptoms had begun immediately after a severe tonsillar inflammation. All the symptoms pointed to a rapidly increasing pressure on the lower part of the cervical cord, more on the left side. The notes of the case made at that time stated that on account of the early history of pain, the lesion was probably extramedullary; that it was probably a tumor, and that its upper level from the beginning was evidently at the level of the fifth cervical segment of the cord.

On January 13, 1910, Dr. Elsberg made a median incision over the spinous processes of the fourth cervical to the first dorsal vertebræ, the exposure and removal of the spines and laminae being done in the usual manner. The slight bleeding was controlled by packings of hot saline solution. The dura was tense, and no pulsation could be seen nor felt. An incision, 5 cm. long, was made in the dura, and was followed by the escape of a moderate amount of cerebrospinal fluid from above. The exposed portion of the cord was much enlarged.

In incising the dura, the smooth posterior surface of the prominent and enlarged cord was nicked in two spots. From the small openings, distinct tumor tissue began to extrude from the otherwise intact cord. The minute openings were then united by an incision on the posterior surface of the cord, and the intramedullary growth became more and more prominent. It was evidently advisable to further enlarge the incision in the cord and allow the natural intramedullary pressure to gradually extrude the growth. The incision in the posterior column was then enlarged until it was 1 cm. long. Under the eye there then occurred a small extrusion of a mass which was clearly tumor tissue, and which seemed to be connected with a larger mass within the substance of the cord.

The operation had thus far lasted only 40 minutes, and little blood had been lost. The patient's condition, however, was not very good; she looked pale; her pulse was 120, and only of fair quality. It was decided, therefore, to desist from further manipulations for the time being. The muscles were carefully sutured together with interrupted catgut stitches, the fascia with a continuous stitch, and the skin edges were united by a sub-

cuticular suture. Over this a voluminous dry dressing was applied. The patient was in good condition on the following day, but the second stage of the operation was delayed for one week.

On January 20, 1910, the wound, which had healed by primary union, was reopened, and the dura and cord exposed. It was then found that a large tumor mass had been extruded from the cord, and lay almost outside of and on top of the cord between the fourth cervical and first dorsal segments. With little difficulty, very slight handling of cord substance, and practically no bleeding, the tumor was peeled out of its bed. Three posterior nerve-roots on the left side, entirely separated from their origin from the cord substance, ended in a thin layer of cord tissue, which formed part of the wall of the cavity left after removal of the tumor.

After careful cleansing of the cavity, the edges of the pia were sutured together with fine catgut; the dura was then closed by a running suture of fine silk, and the muscles and skin were united by catgut sutures. Dry dressing was applied. The duration of operation was 55 minutes. The condition of the patient at the completion of the operation was good: pulse 108, and of good quality; respirations, regular and deep.

The tumor that had been removed was of a reddish-brown color; it was soft and œdematous, measuring 5.3 by 2 cm., and weighing 15 Gm. The specimen was examined by Dr. F. S. Mandlebaum, Director of the Laboratory of Mt. Sinai Hospital, who reported it to be a gliosarcoma.

The patient made a very rapid recovery from the operation. The wound healed by primary union, and all dressings were discarded after the second week.

For the first few days after the operation, the weakness of the extremities and the sensory disturbances were somewhat more marked. After this, rapid improvement followed. By the end of the fourth week the patient was able to sit up out of bed without assistance, and the muscular power in the limbs improved rapidly. The paralysis of the triceps had disappeared. The muscular power in the lower extremities returned somewhat more slowly, but there was a constant and steady improvement. Two months after the operation she was able to stand on her

feet and take a few steps when well supported, but the lower limbs, especially the left, were still very ataxic. Most of the sensory disturbances had by this time disappeared. From the first week after the operation she had had no pain.

At the present time, eight months after the operation, she could use her hands freely, could write without difficulty, and could walk about the room with practically no support. She still had some hypæsthesia in the left hand, and her left leg was still somewhat stiff. She was steadily improving, and this improvement had been much aided by careful massage and exercises.

OSTEOPLASTIC CRANIOTOMY.

DR. ELSBERG presented a woman, 33 years old, upon whom he had operated two months ago. About three years ago she began to suffer from peculiar mental symptoms, with loss of memory. A year later she began to be unsteady on her feet, and to suffer from attacks of headache, with vomiting. During the last year her sight had become progressively worse, the headache and vomiting had persisted, and her mental symptoms became much aggravated, so that she would sit or lie for days without responding to questions or helping herself in any way.

The patient was admitted to the Neurological Institute in the service of Dr. Pearce Bailey, who suspected a neoplasm in the right prefrontal region. The patient had marked choked disk, left-sided ataxia, with exaggerated tendon reflexes in the lower extremities. Dr. Elsberg performed an osteopathic craniotomy and explored the right lobe of the brain, but found nothing abnormal. There was no increase in intracranial tension. The bone flap was returned into place, and a subtemporal decompression done. Recovery from the operation was prompt, and all of the patient's symptoms excepting some difficulty in sight disappeared very rapidly. At the present time the patient was in all respects normal, with the exception of some postneuritic atrophy.

Dr. Elsberg also showed photographs of two cases of brain tumor removed from the posterior fossa of the skull. These patients were now well, the one two years and the other one year after the operation.

CALCIFIED DEPOSIT IN A MESENTERIC GLAND.

DR. JOHN F. ERDMANN showed an X-ray photograph of this condition. The case was that of a man 45 years old, who was supposed to be suffering from gall-stones and a calculus in the right kidney. A series of X-ray pictures was taken, which showed a shadow just to the left of the lumbar spine varying in its site. This was thought to be possibly due to an impaction of bismuth. Upon operation for his cholecystitis the region of the shadow was explored and proved to be a large calcified mesenteric gland, which upon removal was the size of a large chestnut and entirely calcific.

SUBSTERNAL CYSTS OF THE THYROID.

DR. WALTON MARTIN read a paper on this subject, for which see page 737.

In connection with his paper, Dr. Martin showed an illustrative case.

DR. HOWARD D. COLLINS said that in the only case of this kind he had ever seen, there was an accessory thyroid lying behind the sternum, and this had undergone colloid and calcareous degeneration. The patient was a woman of 48, who since her girlhood had suffered from winter bronchitis, and the question arose whether this was due to the presence of the accessory thyroid.

Dr. Martin, in his paper, had made the statement that there had never been any attempt made to remove cysts of the thyroid lying behind the sternum. Dr. Collins said that he published in the *ANNALS OF SURGERY* the history of his case, where he had operated on an accessory thyroid, which consisted of a mass of colloid cysts. In this case he was able to pass his fingers down to the arch of the aorta, and the entire mass was shelled out with the greatest ease. This mass, after its removal, measured three inches in length and an inch and a half from side to side. Its extirpation left a considerable space, showing where the large vessels springing from the arch of the aorta and the recurrent laryngeal nerve had been pushed to one side. Unfortunately, this patient developed pneumonia and died on the eighth day after the operation.

DR. ROGERS said that the extrusion of thick, stringy mucus, to which Dr. Martin had referred in his paper, was quite characteristic of all these cases. The speaker said he had recently operated on three intrathoracic cases, which had convinced him that these thyroid growths could be shelled out with much less danger than would appear, as they usually pushed aside the large vessels in their growth downwards. Also the vessels entering and leaving the tumor were generally close to the points found in the normal gland or close to the second or third tracheal rings.

DR. MARTIN, in closing, replying to Dr. Collins, said there were a large number of cases on record of the removal of intrathoracic thyroid growths; what he referred to in his paper was the removal of a single large cyst. In Kocher's 22 cases referred to in the paper, there was no instance of a single large cyst. The walls of some of these cysts were very thin and were apt to tear, and he believed the removal of the intrathoracic portion would be nearly impossible.

Stated Meeting, Held at the Roosevelt Hospital, March 22, 1911.

The President, DR. ELLSWORTH ELIOT, JR., in the Chair.

DOUBLE UNDESCENDED TESTICLE.

DR. JAMES I. RUSSELL presented a boy of eleven years who was admitted to the Roosevelt Hospital on March 31, 1909, with a double undescended testis. The scrotum was small, and the testis could be felt, one on either side, in the inguinal canal.

Operation: The right side was done first. An incision was carried down to the aponeurosis of the external oblique, which was carefully divided, and the testicle exposed. The internal epigastric artery and vein were ligated and cut, and a small amount of transversalis fascia was divided. The pelvic portion of the spermatic cord was now partly freed by traction and blunt dissection, allowing the testis to be pushed down into the scrotum. The upper part of internal ring was closed. The internal oblique was then sutured to the reflected portion of Poupart's ligament with No. 3 chromic gut interrupted sutures, the aponeurosis of the external oblique was sutured with con-

tinuous plain gut, and the skin was closed with silk-worm gut and continuous silk. No drainage was used. The left side was then treated in a similar manner.

The patient made an uninterrupted recovery, and there had been no retraction of the testes since the operation. But on the contrary at the end of two years in both cases of double orchidopexy the testes were at the bottom of the scrotum, showing descent during that time, since it was impossible to get them to the bottom of the scrotum at the time of operation.

Dr. Russell presented three other cases in which orchidopexy had been successfully done by him for the relief of undescended testes, in boys aged three, nine, and twelve years, respectively. In all of these, the undescended testicles had become arrested in the inguinal canal. In one, the condition was complicated by a congenital inguinal hernia, and in another by a double indirect inguinal hernia. In these cases, an operation similar to that described in the first case was done, and in all of them the result was excellent.

BILATERAL SWELLING OF BOTH HEELS.

DR. RUSSELL presented a boy of eighteen years, in whom, two years ago, both heels suddenly became painful and swollen. The swelling subsided somewhat during the next few days. Since the onset of his attack he had pains in his feet after walking, and went up and down stairs with difficulty. He complained of swelling in the back of both heels at the insertion of the tendo achillis. Denied gonorrhœa and syphilis; Wassermann test negative.

Examination showed a swelling involving the back of both heels at the insertion of the tendo achillis. The swelling was the size of a small orange; it was bony hard to palpation, not tender, and could not be moved upon the os calcis, to which it seemed intimately connected. There was marked limitation of flexion and extension of the ankle-joint. The X-ray showed a distinct shadow, globular in outline, but not of the density that palpation would suggest.

Dr. Russell said the condition being symmetrical, of bony consistence, not of gonorrhœal origin, and not similar to the gonorrhœal exostoses, it offered an interesting problem for diagnosis.

SARCOMA OF THE NASAL FOSSA.

DR. CHARLES H. PECK presented a man, 45 years old, who was admitted to the Roosevelt Hospital on February 7, 1911. Two months prior to admission he noticed that nasal breathing was obstructed on both sides, as though he had a heavy cold. The left side soon cleared up, but the obstruction on the right side persisted. A month later he was examined in the Out-patient Department, and on two occasions portions of an obstructing growth were removed by Dr. James E. Newcomb from the region of the right middle turbinate. Sections of the last specimen were examined by Dr. Mortimer Warren, and reported sarcoma. The patient's previous history was unimportant; there was no history of lues. Examination showed marked obstruction in the right nasal fossa; the nasopharynx and posterior nares were free.

Operation was performed by Dr. Peck on February 16, 1911, under intratracheal insufflation anæsthesia, which was administered by Dr. Charles A. Elsberg. An incision was made along the anterior border of the sternomastoid, and the right external carotid artery was ligated just above the origin of the superior thyroid. This wound was then closed by suture. An incision was then made along the junction of the nose and the right cheek, extending from just inside the inner canthus of the eye to the level of the anterior nares. It was deepened to the bone, and the periosteum was elevated until the nasal process of the maxilla was exposed, and this process was then removed with the chisel and rongeur. The nasal mucous membrane was then incised, and the middle, superior, and inferior turbinates, with the entire mucous membrane of the outer wall of the nasal fossa, including the growth, were excised. The growth was not well defined, but seemed to occupy chiefly the region of the middle turbinate and the adjacent portion of the ethmoid. The ethmoid was removed, including the inner wall of the orbit and the lachrymal bone. The inner wall of the antrum and a portion of the palate bone were also removed, and the mucous lining of the antrum was excised, as it seemed somewhat thickened and the cavity contained pus. During the removal of the ethmoid, the sphenoidal cells were broken into and explored, but they seemed to be free from the growth.

The incision was then extended upward a short distance, the frontal sinus was opened, and its lining membrane excised. It seemed somewhat thickened near the infundibulum, but normal elsewhere, and there was no pus in the cavity. The wound was then carefully closed with deep catgut and silk skin sutures, and drainage was established through the nostril by two strips of gauze, one leading to the region of the ethmoid, the other to the cavity of the antrum.

The operation lasted two hours and a quarter. The insufflation anæsthesia given by Dr. Elsberg was most satisfactory: the return current of air and ether kept the larynx absolutely free from blood and mucus, and it was most interesting to see fragments of tissue, which from time to time escaped into the pharynx, blown up with blood and mucus, so that they could be easily seen and sponged away. The entire absence of cyanosis and respiratory difficulty added greatly to the comfort of the operator, and undoubtedly lessened the shock to the patient. Between eight and nine ounces of ether were used after the commencement of the insufflation anæsthesia. Recovery from the anæsthetic was prompt, and there was little shock.

Excepting for œdema of the eye, which soon subsided, and a slight superficial infection of the wound, the patient's convalescence was uneventful.

Sections of the tissue removed showed that the tumor was confined to the region of the middle and superior turbinates and the nasal surface of the ethmoid. The lining of the antrum, the frontal sinus, and the lining of the deeper ethmoid cells showed no involvement. The pathological report was round-celled sarcoma.

Dr. Peck said that the exposure through the route employed was excellent. There was ample room to deal with the nasal fossa and all the accessory sinuses of one side. For larger tumors of the nasopharynx it would probably be insufficient. The small scar and absence of any considerable deformity of the nose or face was an advantage. The lower portion of the lachrymal duct was cut away, its open end being left free in the wound. It seemed quite possible that it had remained patent, as there was very little overflow of lachrymal secretion.

RUPTURE OF BRACHIAL PLEXUS: FIFTH, SIXTH, AND SEVENTH CERVICAL NERVES: NEURORRHAPHY.

DR. PECK presented a man, 33 years old, a professional bicycle rider, who was admitted to the Roosevelt Hospital on September 29, 1910. On September 5, while riding in a motor-cycle race, he was thrown, his right shoulder striking a fence. There was a fracture of the clavicle, but no other bone injury, and the disability of the arm was attributed to this.

On admission, there was complete paralysis of all the muscles of the arm and forearm, with the exception of flexion of the first and extension of the second and third phalanges of the fingers. There was also slight pronation of the forearm. There was cutaneous anæsthesia, with the exception of (1) the area over the deltoid and axillary regions supplied by the superficial cervical and intercostohumeral nerves; (2) an area over the posterior surface of the forearm and dorsum of the hand; (3) over the middle, ring, and little fingers. There was a corresponding loss of pain, temperature, and muscular sensibility. There was a firm, hard mass in the posterior cervical triangle, about one inch above the clavicle, which proved to be a cicatrix surrounding the torn plexus. A fracture of the clavicle near its middle portion had united. All the muscles of the arm, forearm, and hand were much atrophied. The most severe pain was referred to the thumb.

Operation by Dr. Peck, October 3, 1910: The plexus was exposed and isolated from the surrounding structures, together with the dense mass of fibrous tissue in which it was imbedded. This was then carefully dissected until the fifth, sixth, and seventh nerves could be demonstrated on the proximal side, and the upper and middle primary trunks below. After freely excising the cicatrix until nerve tissue that seemed normal was reached, it was possible to coapt the fifth and sixth proximal segments to the upper primary trunks. The destruction of the seventh and the middle trunk was more extensive, but a strand which probably represented the anterior division of the middle trunk was sutured to the seventh cervical without great tension. The main part of the middle trunk was so much shortened after excision of the cicatrix that lateral implantation into the lower trunk, formed by the eighth cervical and first dorsal, seemed

the only possible resource, and this was consequently done. This trunk was not torn.

The wound was closed and the arm at first put up in vertical suspension, which was later changed to an elevated position, with the hand behind the head. This position was maintained until the fifteenth day. The wound healed promptly, and the patient left the hospital on the eighteenth day after operation. Daily use of the galvanic current, with massage, had been faithfully carried out, but no improvement in motion was noted until about February 1, 1911, four months after the operation. On February 9 he was able to supinate slightly, to attempt a little flexion at the elbow, and to move the fingers more freely. The pain referred to the thumb had been persistent and distressing.

An examination made on March 18 showed increased power in pronation of the forearm and flexion of the fingers and wrist, very slight extension of the wrist, slight supination, slight flexion at the elbow, and fairly strong adduction of the arm. Anæsthesia was still complete in the distribution of the musculospiral and circumflex nerves, and in part of the median and ulnar.

CICATRICIAL STENOSIS OF THE LARYNX FOLLOWING LARYNGOTOMY FOR SYPHILITIC PERICHONDRITIS.

DR. PECK presented a man, 33 years old, who was admitted to the Roosevelt Hospital on September 25, 1910. He had contracted syphilis twelve years ago, and underwent a short course of treatment at that time. Nine months ago his voice became husky, and he began to have spasmodic attacks of laryngeal dyspnœa. He was under treatment in two hospitals in this city with no appreciable relief of symptoms. Early in September the attacks of dyspnœa became more severe and frequent, and were accompanied by expectoration of blood. When admitted to the hospital, he was on the verge of asphyxiation, suffering from marked cyanosis, with intense inspiratory and expiratory dyspnœa. Laryngoscopic examination showed a great thickening of the epiglottis and arytenoids, with but a small chink for the entrance of air. A high tracheotomy was performed at once, with immediate relief. When the tube was removed, on the sixth day, the breathing and voice had improved, and the tracheal wound was allowed to close. He had been given heavy doses of mixed treatment from the time of his admission.

When the patient left the hospital, on October 14, 1910, he went on a spree and forgot to continue his treatment. He was readmitted on October 31, again suffering from severe dyspnœa. Examination of the larynx showed great swelling and infiltration of the entire larynx, most marked on the left side. The true cords could not be seen. On the following day, tracheotomy was again performed. On November 2 he was given 0.6 Gm. of salvarsan subcutaneously. Eight days later, a laryngoscopic examination made by Dr. James E. Newcomb and Dr. Edward L. Williamson showed little change in the local condition, but on November 16 a considerable improvement was noticed. Attempts to remove the tracheotomy tube were immediately followed by dyspnœa, which necessitated its replacement. On November 27 mixed treatment was resumed and continued until January 2, 1911, when he was given 0.6 Gm. of salvarsan intravenously.

Since that time the improvement in the laryngeal condition had been quite marked, but it had not been possible to do without the tracheotomy tube. Several attempts to intubate with large O'Dwyer tubes had failed on account of immediate expulsion of the tube. On February 6, under ether anæsthesia, a Rogers plugged tube was inserted; this was retained for 48 hours, when it had to be removed on account of pain and fever. On February 25 he was again anæsthetized, the stricture was dilated, and measurements were taken for a new plugged tube. On March 11 an attempt was made to insert this tube, but it failed, as the measurements had been faulty and the tube was too large.

On March 18, Dr. John Rogers, at the request of Dr. Peck, after dilating the larynx under anæsthesia successfully intubated with a specially long tube which was not plugged; this was now in place and the patient was able to breathe easily through it. He had learned to swallow fluids in the Castleberry position, and was beginning to take soft solids.

Dr. Peck said that after watching Dr. Rogers's skilful introduction of the tube, he had found that his own failures had been largely due to the fact that he had not gotten the tubes far enough down in the larynx. The plan was to replace the present tube in a short time with one of the same length and shape, but of slightly larger calibre, increasing the calibre with each new

tube until the full dilatation was obtained. Dr. Rogers had told him that the cure of such a stricture usually took from two to three years, but that a permanent cure might be confidently expected.

POPLITEAL ANEURISM: ENDO-ANEURISMORRHAPHY
(OBLITERATIVE).

DR. PECK presented a married man, 33 years old, a painter by occupation, who was admitted to the Roosevelt Hospital on February 2, 1911, complaining of a tumor in the right popliteal region. Six weeks before admission the right foot and leg became swollen, and he had noticed for the first time a swelling in the popliteal space. This had not been painful excepting for slight pain back of the knee when the leg was fully extended; it was slightly tender. He denied a specific history, but the Wassermann reaction was positive. There was no history of trauma.

Upon examination the right leg was found to be swollen, the circumference of the right calf being 40 cm. and that of the left 35 cm. In the right popliteal space there was a rounded swelling, about two and a half by three inches in diameter, with expansile pulsation, systolic thrill, and a loud bruit.

A Matas-Moskovitz test of the collateral circulation, compressing the femoral over the pubic arch while the Esmarch bandage was applied from the tips of the toes to the upper border of the aneurism and then released, showed a return hyperæmic wave to the toes in three and a half minutes. As no suitable arterial compressor was available at this time to occlude the artery just above the aneurism for this test, a further test by the use of the Halsted metal band, placed on the femoral low in Hunter's canal, was made as the first step of the operative procedure.

Operation, February 4, 1911: The right leg and thigh were tightly bandaged with an Esmarch rubber roll from the toes to Scarpa's triangle, and a tourniquet applied as high on the thigh as possible. The Esmarch was then removed, leaving the thigh and leg blanched and the aneurism stilled. The femoral artery was then exposed low in Hunter's canal, and a Halsted metal band was applied and tightened to obliterate the lumen. The tourniquet was then removed. The hyperæmic blush came

with a rush to a little below the level of the band, and then advanced more slowly: it reached the tubercle of the tibia in one minute and twenty seconds; the middle of the calf in two minutes, and the malleoli in about four minutes, but it was eleven minutes before the toes were pink, the great toe being still quite blanched when the operation was proceeded with.

The tourniquet was reapplied, and with the patient in the prone position the aneurismal sac was laid freely open and the clot evacuated. The aneurism was fusiform in shape, with no vestige of normal arterial wall connecting the openings of entrance and exit of the main vessel. A deep sacculation extended forward above the head of the tibia. Both openings were sutured with two tiers of No. 0 chromic gut, and the deeper portion of the sac, with the openings of small collaterals, was obliterated by superimposed continuous sutures of the same material. The redundant walls of the superficial portion were then brought in contact with mattress sutures of heavier chromic gut, and the wound was closed without drainage.

On removal of the tourniquet before suture of the soft parts, hæmostasis was found to be perfect. The wound over the artery, which had been closed by temporary sutures, was then reopened, the metal band was removed, and the wound closed by suture. Inspection of the popliteal wound after this procedure showed no fresh bleeding. The main wound healed primarily, but there was a superficial infection in the wound over Hunter's canal. The collateral circulation was perfect, and the foot, though somewhat pale, was warm from the first. Convalescence was uneventful, and the patient was allowed out of bed 21 days after the operation.

Dr. Peck said that the preliminary testing of the collateral circulation, so strongly urged by Matas before proceeding with an operation which was likely to result in obliteration of a vessel, seemed most important. The method employed in this case might be unnecessary if proper apparatus was available to effectually compress the main vessel just above the aneurism. Nevertheless, this was perhaps a more perfect test. Abundant experimental work by Halsted, Matas, and others had shown that if properly applied, the bands could be put on tightly enough to completely occlude the artery, and could be removed at any time within 72 hours without damage to the intima or the integrity of the vessel wall.

Dr. Peck said he thought the employment of the band for temporary or partial occlusion of important vessels had a field of usefulness which was not yet thoroughly appreciated.

RADIOGRAPHS AFTER GASTRO-ENTEROSTOMY.

DR. PECK showed a number of radiographs taken by Dr. Edward Leaming, Attending Radiologist to the Roosevelt Hospital, illustrating the present gastric condition in patients who had been operated on by gastro-enterostomy after the lapse of various intervals. These pictures were taken after the patients had swallowed an emulsion of bismuth, so that the outlines of the stomach were clearly defined. Three radiographs were taken of each patient at intervals of 2, 15, and 30 minutes after taking the bismuth gruel. In all of the six cases presented, prompt emptying of the stomach through the gastro-enterostomy opening was shown. Bismuth showed plainly in the upper jejunum in the plates taken within two minutes, and after 30 minutes the stomach was nearly emptied.

FRACTURES AND DISLOCATIONS TREATED BY THE OPEN METHOD.

DR. A. V. S. LAMBERT showed a series of these cases, in which the technic employed by him differed somewhat from any he had seen described. The holes in the bones were made by means of a twist drill, such as is used by metal workers. This cut a clean hole in the bone, and did not cause a crushing of the trabeculae alongside of the hole, as did the ordinary bone drill. This twist drill was accurately graded for the proper sized screw, and made a hole the exact size of the shank of the screw. He then used a tap, which, being made of very highly tempered steel and provided with a sharp cutting edge for the thread, cut a groove or thread in the bone at the sides of the drill hole, and here again all crushing of the trabeculae was avoided. The machine screws that were used had the same thread as that of the tap, and were very easily inserted with scarcely any friction or resistance until the final twist was given to them in screwing them tight to hold the plate. These screws, when applied in the above manner, had a greater holding power than did the wooden screws so universally used. The speaker said he used a No. 6 machine screw with a 30 thread, in the smaller bones, and a No. 8 machine screw with a 24 thread, for the larger bones.

Dr. Lambert said that this series of cases was treated at the Roosevelt Hospital, in the service of Dr. Charles H. Peck.

CASE I.—Fracture of the shaft of the femur, upper third. Fracture of the shaft of the tibia and fibula, middle third. Open reduction. This patient was admitted to the hospital on September 14, 1909, with the following history: On June 29, 1909, ten weeks before admission, he was in an automobile accident and fractured both bones of the leg and also his femur. He was treated by splints, traction motion, and other means, but at the end of treatment he had no union in any of the fractures, and there was four inches shortening.

On September 15, 1909, he was operated on by Dr. Lambert, and the tibia and femur were placed by means of aluminum plates and machine screws. It required considerable traction and manipulation to overcome the four inches of shortening. The wound was closed without drainage and healed by primary union. The splints were removed at the end of twelve weeks, when union was firm and the position of the fragments was perfect.

CASE II.—Fracture of the shaft of the femur, middle third. This was a girl, seven years old, who was admitted to the hospital on May 4, 1910, with the following history: On the day of admission she was knocked down by an automobile and sustained a fracture of the left femur. After traction for two weeks there was still two inches of shortening, and the X-ray showed pronounced displacement.

Operation, May 18, 1910: An aluminum plate was fastened to the bone by machine screws. During the manipulation, a small fragment of bone was broken off from the upper end of the lower fragment. The wound was closed without drainage, and healed by primary union. The cast was removed at the end of the sixth week, when union was complete and the fragments in perfect position.

CASE III.—Fracture of shaft of the femur, middle third. The patient was a girl, ten years old, who was knocked down by an automobile on the day of admission, sustaining a fracture of the femur. After two attempts at reduction, the X-ray showed an oblique fracture, with small fragments and comminution, and one inch overriding.

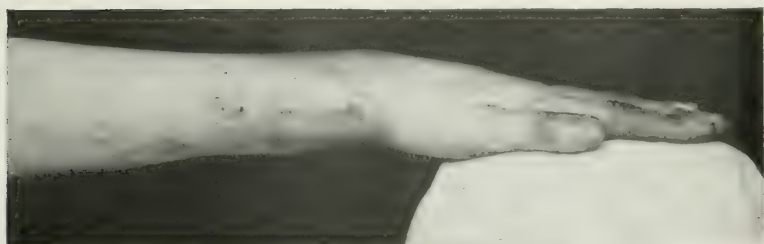
Operation, December 3, 1910: The fragments had an oblique

FIG. 1.



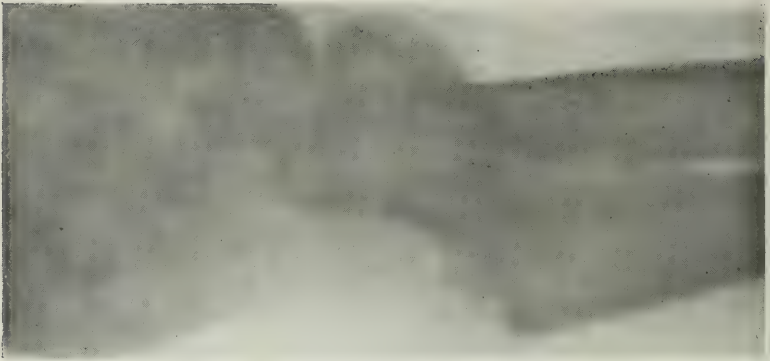
Deformity remaining six months after injury. External view.

FIG. 6.



External appearance after treatment.

FIG. 2.



Skiagraph showing amount of displacement of lower fragment of radius. Lateral view.

FIG. 5.



Lateral view. Fracture reduced and fragments fixed by plate and screws.

FIG. 3.



Skiagraph giving anteroposterior view of fracture of lower end of radius, before operation.

FIG. 4.



Anteroposterior view after reduction by open operation and fixation by plate and screws.

FIG. 7.



Dislocation of elbow; both bones forward.

line of fracture, and a small fragment from the posterior surface of the upper fragment made it possible to approximate the anterior edges only, leaving a gap on the posterior surface. With the aluminum plate and machine screws, the fragments were held in good position. The wound was closed without drainage, and healed by primary union. The cast was removed on January 3, 1911, when union was found to be complete.

CASE IV.—Fracture of the shaft of the femur, lower third; ankylosis of the knee-joint: open reduction.

The patient was a woman, 41 years old, who was admitted on January 7, 1910, with the following history: Three days previous to admission she slipped on the icy pavement and fell; her right leg, which had been ankylosed for 33 years, bent under her, and she felt the bone break above the knee. Examination showed a fracture of the lower third of the left femur, with crepitus and false point of motion. The lower fragment was found posterior to the upper. The knee was ankylosed to an angle of 150° , and showed a slight posterior subluxation of the tibia.

The patient was anæsthetized on January 8, 1910, and again six days later, and on both occasions an ineffectual attempt was made to bring the fragments into position and to maintain reduction with a plaster cast and spica. The great difficulty encountered in maintaining reduction was the ankylosed knee.

Operation, January 19, 1910: The parts were exposed, and an aluminum plate was fastened to the bone with machine screws. The wound was closed without drainage and healed by primary union. The cast was removed after eight weeks, when perfect union was found to exist.

CASE V.—Old fracture of the lower extremity of the radius. Colles. The patient was a man who was admitted to the hospital on February 13, 1911, with the following history: Six months prior to admission he fell, fracturing his forearm just above the wrist. It was immobilized for two weeks, and since then he had limited motion and a painful wrist. There was a marked "silver fork" deformity of the left wrist (Figs. 1, 2, and 3), with a point of tenderness over the outer side of the radius, one inch above the wrist-joint. No crepitus; no false point of motion.

Operation, February 17, 1911: Two incisions were made, one over the postero-external aspect, and a second over the antero-

external aspect. The impaction was broken up with difficulty, and reduction was accomplished only after prolonged traction, manipulation, and division of the periosteum and callus on the posterior surface. The two fragments were in contact only along their anterior borders, as there was a loss of substance on the posterior portion of the lower fragment, due to crushing following the impaction.

A plate of aluminum having a curve corresponding to that of the normal anterior surface of the radius was firmly screwed to the two fragments by means of four machine screws. (Figs. 4, 5 and 6.) The wound was closed without drainage and healed by primary union. Function now is only slightly restricted in supination, otherwise normal.

CASE VI.—Forward dislocation of both bones of the elbow: open reduction. The patient was a boy who was admitted to the hospital on December 17, 1910, with the following history: Fifteen weeks previous to admission he fell during an epileptic seizure, striking his right side and dislocating his left elbow, both bones being displaced backwards. The dislocation was reduced in the accident room. A month later he had a similar injury, which was reduced by a private physician. Five weeks ago he again fell, striking on his left elbow and injuring it for the third time. This was treated by a private physician, who said he reduced it and then placed the arm in a plaster splint.

Upon his admission to the hospital, it was found that the patient was unable to flex or extend the forearm. Pronation was possible to a limited degree, and supination was very limited. There was also ulnar nerve paralysis. The lower end of the humerus was readily palpable beneath the skin on the posterior aspect of the arm. The bones of the forearm could be made out anteriorly (Fig. 7), but their anatomical landmarks could not be identified distinctly on account of the overlying soft parts.

Operation: The orbicular ligament was found unruptured; the triceps was only partially detached from the olecranon, and was stretched very tensely over the inner border of the humerus. The ulnar nerve was not seen during the operation. The internal epicondyle, which was detached from the humerus and attached to the coronoid of the ulna, was removed. The bones were then replaced, and the wound closed without drainage. It healed by primary union, and passive motion was commenced on the ninth day.

FIG. 8.

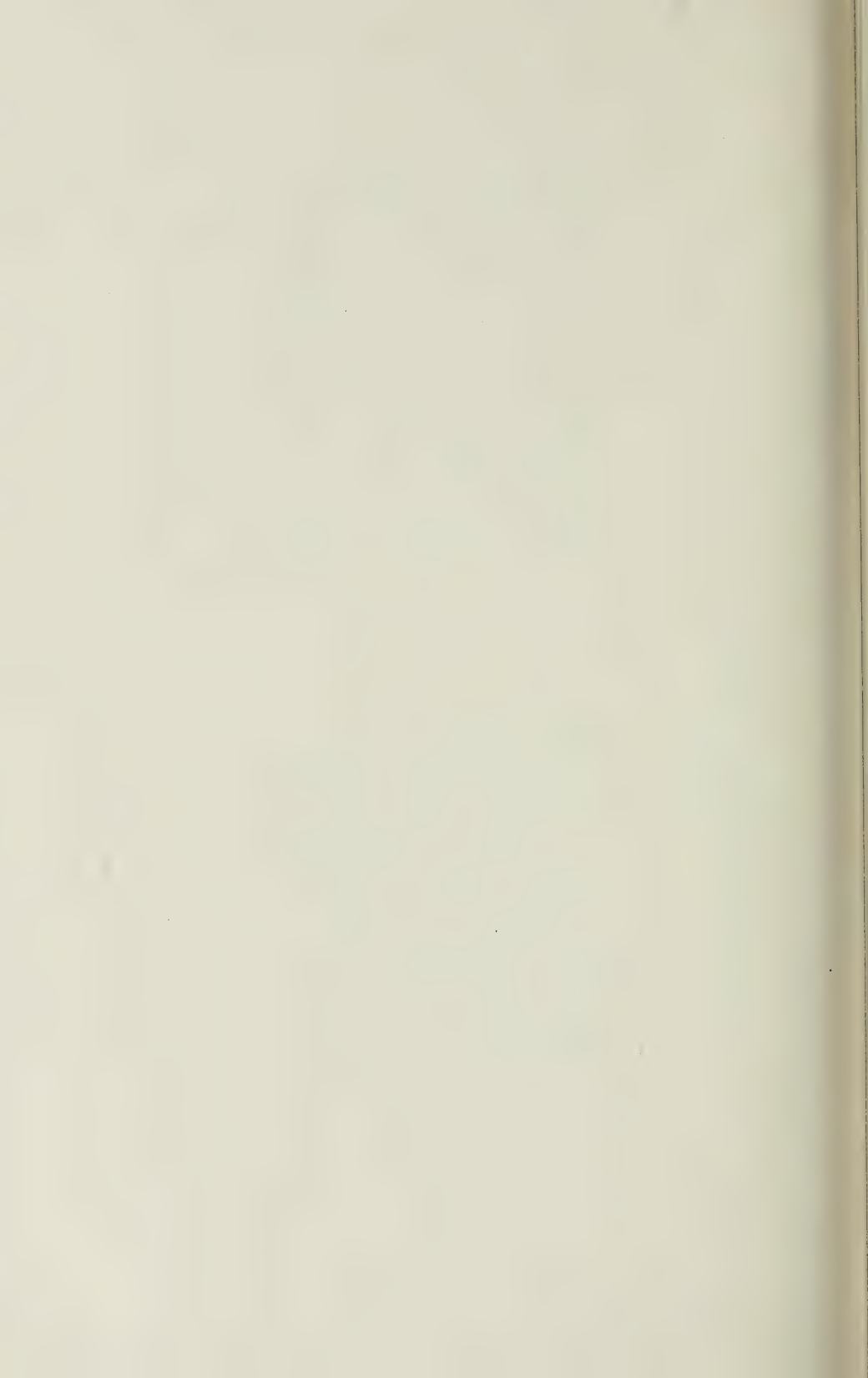


Epithelioma of lip before operation.

FIG. 9.



Result of plastic operation for replacing a lower lip which had been removed by operation.



The patient now had complete flexion, supination, and pronation, but extension was limited to 170° . The ulnar nerve paralysis was still present, and showed no improvement.

PLASTIC OPERATION FOR REPLACING A LOWER LIP WHICH
HAD BEEN REMOVED FOR CANCER.

DR. CHARLES N. DOWD showed a man whose entire lower lip had been removed for epithelioma six months previously. He was shown to illustrate the advantage of replacing the defect by flaps drawn forward from the lower part of the face on each side. The method was described several years ago (*The Medical Record*, Feb. 20, 1897), and the results obtained by it had been excellent, several of the patients having gone a number of years without recurrence. Good access was obtained to the submaxillary regions, from which the lymphatics were carefully removed. Sufficient skin to cover the defect was slid forward from the sides of the face, and the mucous membrane for forming the vermilion border of the lip came from the inner side of the cheeks. Redundant tissue was removed by taking a wedge-shaped piece at the nasolabial fold.

The patient's appearance before and after operation was shown in the accompanying photographs. (Figs. 8 and 9.)

SEPTIC KNEES (THREE CASES).

DR. CHARLES N. DOWD showed three cases to illustrate the two following points in the treatment of suppurating knee-joints: (1) that in certain instances, drainage through small incisions was more desirable than an extensive operation; (2) that if the cutting of the patellar ligament and a wide exposure of the joint were deemed wise, ankylosis did not necessarily follow in children.

CASE I.—The patient was a fairly robust man, who was subject to pharyngeal inflammations and had a peritonsillar abscess, which was incised May 16, 1910. He was admitted to the Roosevelt Hospital on May 22, and remained on the surgical division for four days, running a high temperature. He was then transferred to the medical division and treated for a pneumonia which had developed. On June 3 he was sent back to the surgical division for the treatment of a suppurating knee-joint.

Under these conditions, Dr. Dowd said, some surgeons would have advised opening the joint very widely, washing it out, and establishing thorough drainage; others would make a very small incision for drainage, and carefully avoid doing other injury or violence to the joint. Again, others would aspirate the pus and inject some antiseptic fluid.

Dr. Dowd said he was guided in his procedure by the general condition of the patient. Although he had shown three foci of infection, the peritonsillar abscess, slight pneumonia, and sup-puration of the knee, he did not look very septic. His temperature, which at first had for several days been about 104° , had fallen to 100.8° , and his pulse was 80. It seemed wiser to be guided by this than by his multiple foci of infection, or by the fact that streptococci had at first been found in the blood and in the pus from the knee. Therefore, under nitrous oxide anæsthesia, a small incision was made in each side of the joint. Coagulæ, which were seen within the joint, were not even disturbed, the margins of gauze strips were inserted within the synovial incisions, an absorbent dressing was applied, and the leg immobilized.

Drainage was obtained with the minimum of traumatism in the belief that the patient could thus fight his sepsis better than he could if his knee received too much trauma, somewhat as we find that appendix cases do better when the general peritoneum is not unnecessarily disturbed.

The patient's convalescence was slow, but he had far less suffering than patients with septic knees usually had. He left the hospital at the end of two and a half months with his wounds healed and his knee stiff, but permitting a few degrees of motion (about 15°). During this period, another evidence of his septicæmia had appeared in the shape of an abscess in the neck, which contained streptococci, and which had been incised and had healed.

Since last September the patient had been at work most of the time. His knee had been baked a good deal, and he now walks very well, holding his leg fully extended and having 20° of voluntary flexion in the knee-joint.

CASE II.—This was a strong negro, 32 years old, who on June 30, 1910, was shot diagonally through the leg, the bullet grazing the knee-joint and going through the tibia. When he

came to the hospital, ten days later, he had a suppurating bullet wound, and the knee was distended with streptococcic pus. His temperature was 103.8°, pulse 90.

On exploring the bullet wound, it was found that this was the cause of at least a large part of his symptoms, and silkworm gut strands were accordingly passed through the bullet track in the bone to secure suitable drainage. The problem which he presented was similar to that of the preceding case, as he had a suppurating knee-joint and symptoms due in part to that and in part to other lesions. The joint was therefore drained with the minimum of tissue disturbance, and the leg was immobilized.

The subsequent illness in this case was more trying than that of the first patient, but his symptoms were due to infection about the joint and the bullet wound, not to inflammation within the joint. At the end of four weeks, in spite of most careful dressing and efforts at drainage, there was so much boggiess of the leg and the constitutional evidences of sepsis were so pronounced that a second operation was done. Much periarticular inflammation was present, and there was a posterior abscess which burrowed above the popliteal space. In order to avoid possible error concerning the knee itself, a cut was made across the patellar ligament and the joint was inspected and found to be in excellent condition. Its upper part was filled in with granulation tissue and almost obliterated; there was no pus between the bones or in the posterior part of the joint, and the bones were in good condition.

The leg was immobilized in flexion, with the patella laid upward, but after six days it was straightened without resection of the bone, and healing slowly followed. The wide exposure of the joint was made as a diagnostic safe-guard, but the absence of intra-articular inflammation and the prompt relief which followed drainage of the periarticular abscesses indicated that this exposure served no other good purpose. The patient's convalescence was slow but uninterrupted, and he left the hospital two and a half months after his admission. He had received massage and baking since, and now had a straight leg with ankylosis of the joint.

Dr. Dowd said the treatment of these cases by simple incision was entirely in accord with the teachings of Peck (*ANNALS OF SURGERY*, vol. xlv, p. 409) and Mayo (*Loc. cit.*, vol. xxi, p. 37),

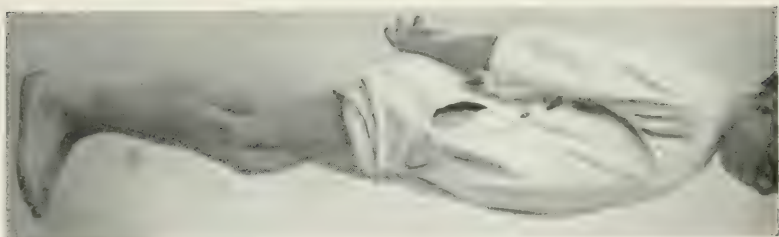
who had, under certain conditions, advocated the division of the patellar ligament in order to secure abundant drainage. Dr. Peck particularly drew attention to Flint's studies, with his report of 62 cases of suppuration of the knee, with 89 per cent. of recovery after various procedures, and he reserved the transverse operation for those cases that had been suffering for a long time, and whose infection had been severe from the onset and in whom the joint was disorganized. The transverse drainage, however, was so attractive a procedure that there might possibly be a tendency to use it in patients who would do better by the simple drainage.

CASE III.—Dr. Dowd said this case illustrated the possibility of obtaining good motion after severe suppuration and extensive surgical procedure in the joints of children. This patient had already been shown at a meeting of the Society on March 24, 1909, when he had partially regained his power of motion, and he was now shown with a degree of motion which was remarkable. In November, 1908, when he was six years old, a transverse incision was made into the knee-joint for a very virulent infection (*ANNALS OF SURGERY*, vol. 1, p. 482). The leg was immobilized in flexion, with wide drainage of the joint, and was straightened without bone resection three weeks later. Four months afterwards, when the patient was presented before the Society, he walked fairly well, having about 30° of motion. In the intervening two years he had played about, as boys generally did, and had had no definite treatment. He was now able to walk and run so well that one could not distinguish that he had ever had a knee-joint operation. He was able to extend the leg almost to the normal position, and had at least 50° of voluntary motion (see Figs. 10 and 11). He walked and ran without limping, and stated that he did not become unduly tired. The patella was situated one inch higher than that in the opposite knee, but this did not seem to occasion him any inconvenience.

CHOLELITHIASIS; LIVING TYPHOID BACILLI FOUND IN
GALL-STONES THIRTY-TWO YEARS AFTER THE FEVER.

DR. CHARLES N. DOWD presented a man who was admitted to the Roosevelt Hospital in August, 1910, having had attacks of biliary colic for 20 years. He gave a history of having had typhoid fever 32 years ago.

FIG. 11.

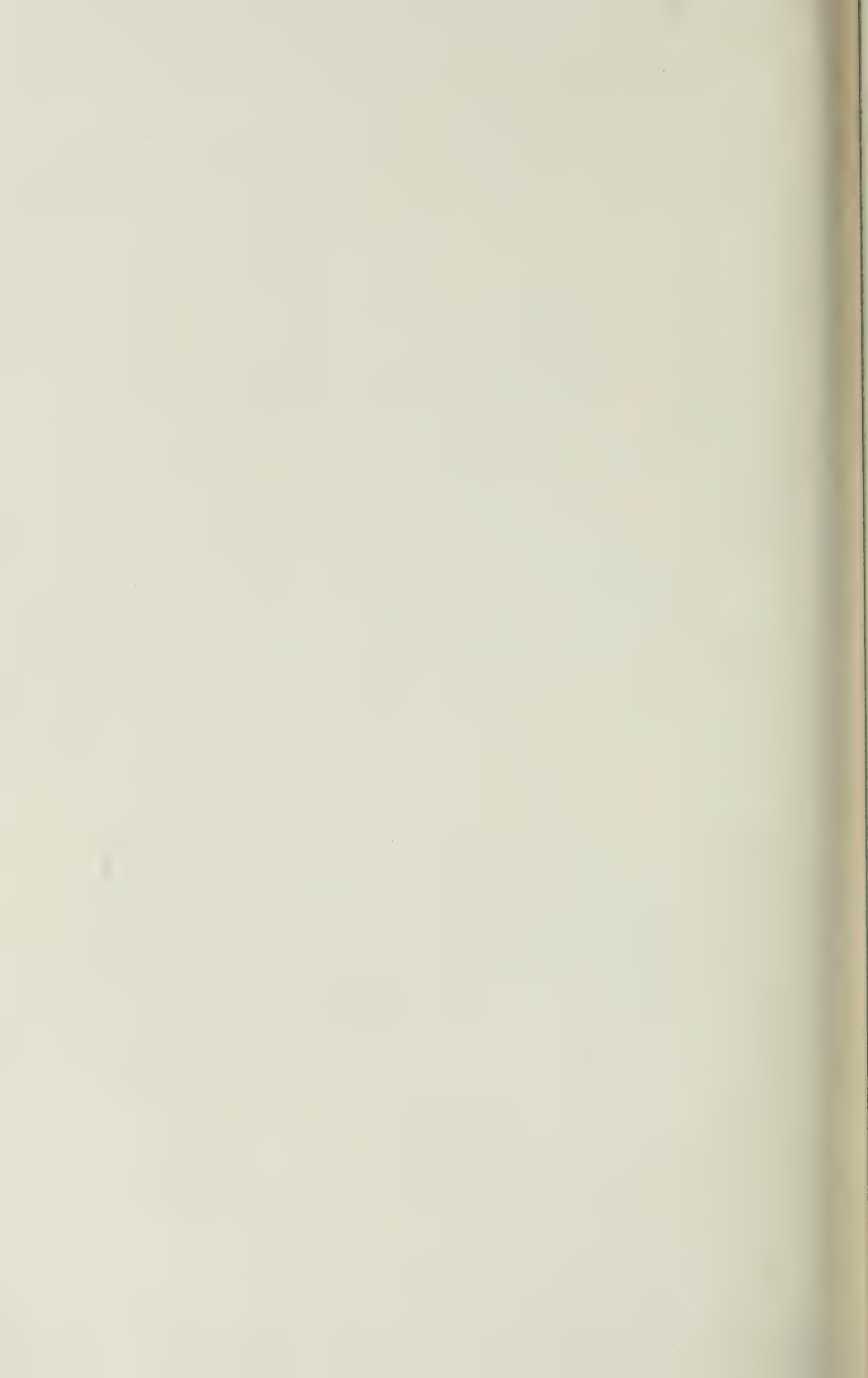


Result of transverse incision and drainage of child's knee-joint for severe suppuration. Extension.

FIG. 10.



Result of transverse incision and drainage of child's knee-joint for severe suppuration. Flexion.



At operation, two large gall-stones were removed, one and a quarter inches in diameter, together with several small ones. As living typhoid bacilli had so frequently been found within gall-stones, one of the larger stones was sent to the laboratory for bacteriological examination. From its interior, cultures of living typhoid bacilli were obtained, which grew in the characteristic manner. Of course, no one could tell the exact time when they had formed the nidus of the gall-stone, but the period must have been a very long one.

This case, the speaker said, offered another example of the long persistence of the living typhoid bacilli in the gall-bladder. The long viability of these bacilli had been so often demonstrated that this instance, remarkable as it was, did not occasion so much surprise as it otherwise would. The prolonged duration of typhoid contagion in typhoid carriers was a matter of general knowledge. The Health Department of this city had recently traced a case back 47 years, and Lenz (*Clinical Jahrbuch*, 1905, vol. xiv, p. 475) had related a case where it persisted 42 years.

POST-OPERATIVE DEVELOPMENT OF HYPERPLASTIC LYMPH-NODES.

DR. CHARLES N. DOWD presented a child who was operated upon three years ago for tuberculosis of the cervical lymph-nodes. The subparotid nodes were extensively involved in the tuberculous inflammation, and they, together with those of the internal jugular and posterior cervical chains, were removed in the usual way.

The patient was shown to illustrate the development of hyperplastic nodes which frequently came after extensive lymph-node operations. It was not unusual to find a few small nodes, the size of peas or small beans, at the margins of the operative area. Dr. Dowd said he had watched such nodes, in many instances, for a number of years, and had found that they remained almost quiescent, sometimes subsiding and very rarely increasing in size. At times, the physicians and the patient's friends were anxious about them, but they were so seldom tuberculous that they had not often been removed, and when such nodes had been removed, microscopic examination had usually shown them to be non-tuberculous.

The patient shown by Dr. Dowd was a child, who a year

and a half after his operation developed caries of a tooth, and later, inflammation in the surrounding tissues. Last November, he came to the hospital with a bean-sized node directly in the locality from which the lymphatics had been removed in the previous operation. Fearing that it might indicate a recurrence of tuberculosis, it was removed. Both macroscopic and microscopic examination, however, failed to show any evidence of tuberculosis. The node had apparently developed in response to the tooth infection, forming a lymphatic protection. It showed the same kind of enlargement which lymph-nodes ordinarily showed in the vicinity of simple pyogenic infection.

The development of these nodes corresponded to what we would expect and what had been learned from animal experimentation, for it was beyond doubt that lymphatics had good power of regeneration, and that they thus met the demands which were put upon them.

OMENTAL CYST.

DR. CHARLES N. DOWD read a paper with this title.

SOME OBSERVATIONS UPON THE SURGERY OF THE URETER.

DR. GEORGE E. BREWER read a paper with this title, for which see page 827. In connection with his paper, Dr. Brewer showed a number of cases illustrating the same.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held February 6, 1911.

DR. GWILYM G. DAVIS in the Chair.

DISJUNCTION OF UPPER EPIPHYSIS OF ULNA.

DR. PENN G. SKILLERN related the history of a boy aged 9 years who presented himself at the surgical dispensary of the Children's Hospital September 10, 1909, with the history of a fall from a height of 10 feet onto his left elbow. In the absence of Dr. Ashhurst he was examined by Dr. Skillern, who discovered moderate pain, moderate swelling about the elbow, and localized tenderness at the upper extremity of the ulna. At this point a small fragment corresponding to the olecranon tip could be grasped and moved from side to side. Between this fragment and the triangular subcutaneous surface of the olecranon was a depression admitting the tip of the little finger, which was rendered more distinct on flexing the forearm and diminished by extending it. Approximation of the fragments in complete extension elicited muffled crepitus. The arm was splinted in complete extension and the epiphysis held in juxtaposition with the bone by an adhesive strip. A skiagram revealed disjunction with slight mesial displacement of the upper epiphysis. (Figs. 1 and 2.)

Dr. Skillern said that this injury is not mentioned in the textbooks or in the literature of surgery. It is, however, referred to in Piersol's "Anatomy" (p. 285), and receives full consideration in Poland's work on "Traumatic Separation of the Epiphyses" (p. 457), in which it is stated that: "the olecranon epiphysis is but a small process, occupying little more than a third of the whole olecranon at about the tenth year. In this cartilage ossification appears at the summit of the olecranon as a single nucleus usually at this period—in rare cases a year or two sooner—and rapidly invades the whole. In the fully ossified state, at the

fifteenth year, the epiphysis comprises the upper aspect of the olecranon with the insertion of the triceps, part of the attachment of the posterior ligament of the elbow-joint, and a small portion of the upper part of the triangular subcutaneous surface posteriorly; on the inner side it is above the tubercle for the flexor carpi ulnaris. The epiphyseal line slopes obliquely downward and backward from the articular surface in front, viz., the upper part of the sigmoid cavity. The epiphysis unites with the shaft at the seventeenth year.

"In regard to age, separation of the whole cartilaginous upper end of the ulna is possible only before the eight year or thereabouts, and pure separation of the olecranon epiphysis can only occur from about the tenth year to the seventeenth or eighteenth, the time of junction with the epiphysis. The rarity of this injury in children, as compared with fractures of the olecranon process in adults, may be accounted for to some extent by the small size and less prominent projection of this process in the former. The posterior aspect of this epiphysis in children before the fourteenth year is on a plane anterior to that of the epicondyles and posterior aspect of the diaphysis of the humerus when the elbow is at a right angle. Consequently, in falls upon the elbow and in other injuries, the force of the blow is much more likely to be received by the epicondyles than by the olecranon.

"The injury is commonly caused by a fall upon the back of the elbow while the elbow is in a flexed position, or by some other direct blow. From indirect violence, either extreme flexion or hyperextension of the elbow may cause disjunction. As for muscular action, it is questionable whether in children violent contraction of the triceps brachii is sufficiently powerful to detach this process, unless it be combined with one or other of the causes mentioned above."

The symptoms, prognosis, and treatment of this disjunction do not differ essentially from those of fracture of the olecranon.

Even fractures of the olecranon before the fifteenth year are rare. Thus, in the table of 2705 fractures treated at the Middlesex Hospital during sixteen years inserted by Flower and Hulke in Holmes's "System of Surgery" (1881, vol. i, p. 845), 76 of the 2705 were fractures of olecranon, and of these 76, 10 occurred before the fifteenth year. The diagnosis of disjunction in this

FIG. 1.



Skiagram of ulna showing separation of upper epiphysis.

- (a) Adhesive strip applied over epiphysis.
- (b) Disjunct epiphysis.

FIG. 2.

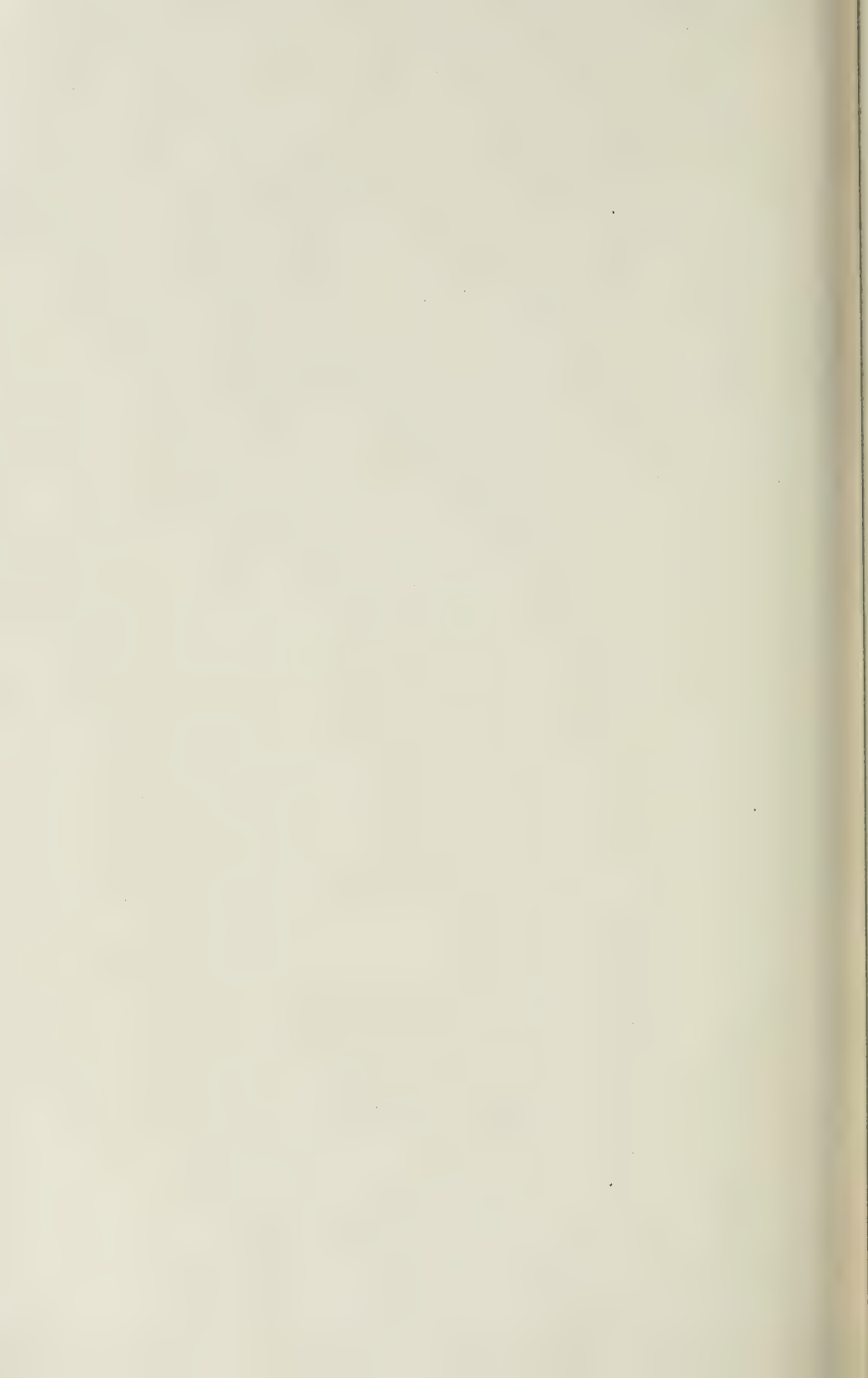


Skiagram of ulna, showing separation of upper epiphysis.

FIG. 3.



Sketch of an ulna from a lad fourteen years of age. Shows extent of olecranon formed by upper epiphysis.



case was suggested by the fact that the patient was in the epiphyseal age,—an important consideration, since, as Poland states, the annual surgical reports of several of the London hospitals mention in their statistics numerous cases of fracture of the olecranon before adolescence, many of which were probably examples of epiphyseal separation. The point may be raised that here, in the case of the olecranon, it is rather an affair more of academic interest than of practical import whether disjunction or fracture has occurred, since in disjunction the growth of the ulna is not interfered with. Yet the speaker thought that many epiphyseal disjunctions in children, especially where no skiagram is made, are mistaken for fractures, and that on the whole it is far better to recognize disjunctions than to stop short of further investigation and diagnose and treat as a fracture. His own working rule in this respect is that since all minors are in the epiphyseal age, severe injuries about the joints should be considered epiphyseal disjunctions until proven otherwise. It is well known that epiphyseal disjunction is more apt to occur than dislocation in childhood, because the epiphyseal unions are weaker than the articular. He believes that in the future epiphyseal disjunctions should be accorded a more prominent place in the text-books than at present. The accompanying sketch (Fig. 3), made by Mr. Erwin Faber, of an ulna from a child aged fourteen, shows just how much of the olecranon is formed by the upper epiphysis.

Examination of the patient at the present time, eighteen months after the injury, reveals perfect function of the elbow-joint.

LAMINECTOMY.

DR. GEORGE P. MULLER read a paper with this title, reporting six cases, for which see page 754.

THE RATIONAL TREATMENT OF ACUTE APPENDICITIS.

DR. JOHN B. DEEVER read a paper with this title, for which see page 798.

DR. JOHN H. GIBBON said that the figures of Dr. Deever point to the value of the Ochsner method of treatment after peritonitis is established. In only a limited number of cases had he himself pursued this policy. It may be of interest in this

connection to take the cases of acute appendicitis (all chronic cases being excluded) occurring in the Pennsylvania Hospital during the past two years, and see what results were obtained there. As a general rule all cases were operated on within a few hours, excepting abscess cases. In considering the mortality of this class of cases it is necessary to include the mortality of cases dying without operation.

These cases had been tabulated by Dr. Billings. These operations have probably been performed by eight different surgeons, comprising the surgical staff of the hospital.

There were 40 acute cases with acute symptoms; nothing outside; no pus. All recovered, being operated upon in an average time of $1\frac{3}{4}$ hours after admission. These all come within the 36-hour period. Next, serious acute cases, suppurative, without definite abscess wall; 33 of these operated on; average time after onset $2\frac{1}{3}$ days; all recovered. Thirty-five cases of appendiceal abscess with well-defined wall and cavity, but no diffuse peritonitis; average time after onset 5 days; all recovered. Of the acute gangrenous cases, there were 39 of these, average time after onset of disease being 2 days. All were operated on within 2 or 3 hours after admission, and all recovered. Of the acute gangrenous cases with perforation of the appendix and general peritonitis, the mortality was high. There were 56 such cases with 43 recoveries and 13 deaths; average time after onset of condition was a little over 3 days. Only two patients died of intestinal obstruction, an important point.

Dr. Gibbon hesitated from these figures to take the ground that the Ochsner treatment ought not to be employed; in fact he did employ it, though not so extensively as has Dr. Deaver. His feeling was that all acute cases of appendicitis should be operated on practically at once. Where there is a diffuse peritonitis, evidenced by clinical symptoms, these cases should be operated upon if within 36 to 48 hours of onset. Of course, the patient's condition must be taken into consideration. Murphy's statistics are striking, he reporting 40 cases of acute perforative peritonitis with but one death, but these were all operated upon within the first 24 or 36 hours of onset. The crux of the matter with hospital surgeons is, what should be done with cases two or three days old? Here a selection must be made which must be the result of individual surgical experience. There is no

question that the mortality to-day is nothing like it was four or five years ago, largely due to the fact that the profession is now beginning to learn that purgation is unwarranted, and that surgeons are realizing that the less traumatism they make, the sooner they get out of the abdominal cavity and establish drainage and enteroclysis, the more chance will their patients have of recovery.

DR. EDWARD MARTIN said that Dr. Deaver implied by his remarks that the diagnosis of appendicitis can always be made. There are exceptions to this which he had seen on the part of most careful practitioners and also on the part of careful surgeons.

He had never seen a case of appendicitis so ill that operation was postponed or foregone because it was a desperate chance. That these cases of acute toxæmia occasionally will recover without operation, he acknowledged, but his experience had been that they recover more speedily after surgical intervention. Surgeons learned years ago from Dr. Deaver to operate the first minute, or the first hour, or the first day that the diagnosis was made, the single therapeutic indication in appendicitis always being operation. A good many lives have been saved by pursuing this policy, and the one which he advocates now constitutes a complicating and confusing addendum to a teaching which admitted of no misunderstanding.

With regard to the use of morphine, he heartily agreed with Dr. Deaver that it is to be avoided if possible, but he has the great bulk of surgeons, especially those who have had their abdomens opened, against him. All of them, even the most rabid antimorphinists, have become converted, when they themselves were suffering from post-operative pangs, and because of the good results from its use many surgeons have become adherents to its routine employment.

DR. JOHN H. JOPSON recalled a former pamphlet by Dr. Deaver entitled "Walled Off," in which he called attention to the danger of allowing appendiceal cases to reach the abscess stage. His early observations of patients treated by this method were made in Dr. Deaver's wards at the German Hospital.

Later in his own service at the Presbyterian Hospital, he was accustomed to seeing one of his colleagues treating patients on the Ochsner plan, and he saw many recoveries with and with-

out operation, some patients, indeed, refusing operation and leaving the hospital apparently well. He therefore had been adopting this plan of late in cases similar to those mentioned by Dr. Deaver, and with most satisfactory results.

DR. GEORGE G. ROSS commented upon Dr. Deaver's claim that peritonitis and appendicitis should be treated as separate conditions, no matter whether the peritonitis follows a perforated appendix or not. Dr. Deaver has always, and does to-day advocate, the taking out of the appendix. He believes that every appendix that has once been inflamed should come out, but also believes that judgment should be exercised as to the proper time at which to remove such an appendix. In peritonitis there is a different problem. Some cases never need operation, and do not come to it. For instance, consider the number of cases of pelvic peritonitis with more or less diffusion of fluid above the ileocecal line, due to pyosalpinx when both the peritonitis and the tubal infection subside. He knew of one case which had a violent diffuse peritonitis in which the tubes discharged themselves through the uterus. The woman subsequently became pregnant and bore a child at full term. Perforative peritonitis sooner or later will come to operation. There are some cases of appendicitis where the perforation occurs at the base of the appendix, or where the appendix is behind the cæcum with the tip in the pre-kidney fossa, when the infection is into the retroperitoneal space and directly into the lymphatic system; very few if any such cases recover. This space cannot be drained and the poison is taken up so readily and so rapidly that the patient has practically no chance of recovery. He felt more apprehension with an abscess behind the cæcum causing pressure necrosis than he did with the general peritoneal cases.

DR. JOHN H. GIBBON recalled a case seen by him some months ago. The patient was a girl 14 years of age, who was taken sick in Brooklyn and had been ill for three days before she was brought to the Jefferson Hospital. She had an abdomen tender, not distended, but rigid. She had been vomiting; had a very high leucocyte count, and fever. Appendicitis with general peritonitis seemed the more likely diagnosis, and appendicitis had been the original diagnosis made in Brooklyn. When he opened her abdomen he found a lot of bloody exudate and a gangrenous ovarian tumor with a twisted pedicle.

If he were to see another such case now, he did not believe he could differentiate it from one of acute appendicitis. Now had he pursued the plan of waiting for a few days in this case, he felt confident the patient would have died. After the operation she made a good recovery.

DR. GWILYM G. DAVIS remarked, with regard to the difficulty in diagnosis, that attention should be called to those cases in which the appendix lies in the pelvis, and as it becomes inflamed the pus passes up underneath the small intestines, works over the bladder, and up the left side; there is then an inflamed mass covered with small intestine; such a condition obscures the diagnosis and renders the treatment very difficult.

DR. GEORGE P. MULLER thought that in the consideration of the indications for this method of treatment too much attention is paid to the pathology of the disease. Some who had spoken had referred to the dangers of the posterior position, to the fact that perforations near the base are more dangerous than those near the tip, etc. It is impossible to diagnose the pathology of appendicitis with any degree of certainty until the abdomen has been opened, nor did he think that surgeons should accept a certain number of hours as the time limit indicating postponement of operation. What is needed is to find some method by which the resistance of the particular patient can be estimated, so as to determine whether his abdomen should be opened at once or whether delay would enable him to recover from the infection. Mikulicz was engaged upon this subject at the time of his death, and some effort has been made by the use of the so-called "vaccines" to increase resistance, but nothing promising has as yet been brought forward.

DR. JOHN B. DEEVER, in closing, said that the best working rule is that which gives the best results in the majority of cases. He did not wish for one instant for any one to believe that every case of appendicitis operated upon by him was diagnosed as such before operation. He had committed Dr. Gibbon's error in children as well as in adults, and there are other conditions to which he could also call attention, but his paper was not on the diagnosis but on the treatment of acute appendicitis.

In the first edition of his book on appendicitis he urged that every case of appendicitis, whether or not complicated by peritonitis, should be operated upon. He had now learned better.

The mortality at the German Hospital under his present treatment as compared with that under former methods is exceedingly gratifying, and he attributed the better results to the present method of treatment and to the better diagnostic powers gained through experience.

He quite agreed that the decision regarding whether or not to wait in cases of acute appendicitis should be made only by the surgeon.

With regard to Dr. Muller's remarks, he considered his suggestion an important one, for the resistance of the patient is the whole secret of this treatment. If he is not in a condition to withstand the toxæmia, then waiting will do no good, but harm. The bulk of patients, on the other hand, who get well without operation, assuming that the diagnosis is correct, may not have withstood the ordeal had surgical interference been instituted.

The question of the time of appearance of the peritonitis can only be calculated from the character of the pain. His rule is not to calculate the peritonitis from the onset of the disease, but from the onset of the most severe pain. In the majority of cases of acute appendicitis during the first hours the pain is general, then there is a history of sharp pain immediately followed by diffuse soreness of abdomen, etc., although this is not absolute.

Dr. Gibbon referred to the question of intestinal obstruction. Formerly the average number of cases of this condition at the German Hospital was about one in 50 or 60; one year they had 13 obstructions. Now in 1910 there were only two cases of intestinal obstruction, so that would refute the belief that the line of treatment recommended predisposes to obstruction.

INDEX TO VOLUME LIII.

A

- Abdominal Cavity, Cystoscopy of the, 764; Incision, Removal of Wedge of Skin and Fat in the Course of, 364; Sarcoma, Cure of, by Mixed Toxins, 299; Sections, Multiple, in one Patient, 728.
- Adenoma of the Intestine, 416.
- ALEXANDER, EMORY G.: Fracture of the Patella, 508, 581.
- ALEXANDER, SAMUEL: The Technic of Median Perineal Prostatectomy, 390; Choice of Operation for Removal of Prostate, 441.
- Anatomy, Applied, by Gwilym G. Davis, Review of, 448; Surgical, by John A. C. Macewen, Review of, 157.
- Anæsthesia by Intratracheal Insufflation of Air and Ether, 161, 302, 749.
- Aneurism of the Innominate Artery, 543; Popliteal, Endoaneurismorrhaphy for, 861; Popliteal, Treated by Matas' Aneurismorrhaphy, 538.
- Ankylosis of the Jaw, 551.
- Appendicitis, Acute, Treatment of, 798, 875; Cases of Complicated, 118; Followed by Spreading Peritonitis, Treatment of, 146; Technic of the Operative Treatment of, 525, 575.
- Appendicostomy in Lane's Operation for Intestinal Stasis, 686.
- Arm Paralysis, Laceration of the Capsule of the Shoulder-joint in the Etiology of Traumatic Combined, 77, 116.
- Arm, Pistol Shot Wound of the, 292.
- Arteries, Testing Collateral Circulation Preliminary to Occlusion of, 1.
- ASHHURST, ASTLEY, P. C.: After-Treatment in Cases of Fracture of the Patella, 584; Cases of Complicated Appendicitis, 118; Subphrenic Abscess a Sequel to Appendicitis, 118; Volvulus of Small Intestine Complicating Appendicitis, 120.
- Aspiration of Peritoneal Fluids, Apparatus for, 575.
- AXTELL, W. H.: Chylous Cysts of the Mesentery, 692.

B

- BERNHEIM, BERTRAM M.: Organoscopy, 764.
- Bladder, Exstrophy of the, 135; Non-prostatic Urinary Retention of the Senile, 57; Urinary, Large Calculus in, 542.
- Blood Transfusion in an Adult, 131.
- Bone Abscess Treated with Moorhof's Bone Wax, 67; Plug, Moorhof, Results of the Use of, at the University of Minnesota, 699.
- Bones of the Hands and Feet, Variations of the, by Thomas Dwight, Review of, 160.
- Brachial Plexus, Neurofibroma of the, 274.
- Brain Injury by Contrecoup, 428.
- Breast Carcinoma in Young Women, 726.
- BREWER, GEORGE EMERSON: Observations upon the Surgery of the Ureter, 827.
- BREWSTER, G. W. W.: Operative Treatment of Wounds of the Heart, 324.
- BROWN, W. H.: Parathyroid Implantation in the Treatment of Tetania Parathyreopriva, 305.
- BRUCE, HERBERT A.: Acute Diverticulitis, 682.
- Bursitis of Thigh and Groin, Tuberculous, 566.

C

- Cæcum, Carcinoma of the, 298.
 Cancer, Injury as a Causative Factor in, 449, 615.
 Carcinoma of the Splenic Flexure, Partial Colectomy for, 297.
 Cardiospasm, Treatment of by Thoracotomy and Œsophageal Plication, 293.
 Cervical Vertebrae, Fracture of the Transverse Process of the Seventh, 284.
 Chest Wall, Sarcoma of the, Thoracotomy for, under Differential Pressure, 304.
 Cholelithiasis—14,000 Calculi Removed at Operation, 590.
 CHURCHMAN, JOHN W.: Acute Hepatitis Simulating Stone in the Common Duct and Liver Abscess, 783.
 Chylous Cysts of Mesentery, 692.
 COBB, FARRAR: Cystadenoma of Supernumerary Kidney, 367.
 COLEY, WILLIAM B.: Cure of Abdominal Sarcoma by the Mixed Toxins, 299; Cure of Sarcoma of the Scapula by Mixed Toxins, 844; Injury as a Causative Factor in Cancer, 449; Malignant Tumors of the Fingers or Hand, 290; Sarcoma of the Humerus, 286; Sarcoma of the Femur, 288; Transplantation of Testis into Scrotum, 844.
 Collateral Circulation, Testing Efficiency of, Preliminary to Occlusion of the Great Surgical Arteries, 1.
 COLLINS, HOWARD D.: Substernal Cysts of the Thyroid, 853.
 Colon, Diseases of the, by P. Lockhart Mummery, Review of, 446; Resection of for Cancer, Result of After 17 years, 542.
 Colostomy, Restoration of Fecal Continence After Iliac, 250.
 CORBETT, J. FRANK: The Damage Done to the Kidney by Operation, 373.

- CORSCADEN, JAMES A.: Intussusception with Special Reference to Adults, 169.
 Coxitis, Double Acute Non-tuberculous, 426.
 Crandon's Surgical After-treatment, Review of, 155.
 Craniectomy, Osteoplastic, 852.
 Cystoscopy of the Abdominal Cavity, 764.
 Cystotomy, Control of Urinary Drainage after, 387.
 Cysts, Retroperitoneal and Mesenteric, 355.

D

- DAVIS, GWILYM G.: Fractures of the Shaft of the Femur, 587; Treatment of Acute Appendicitis, 879; Volkmann's Ischæmic Paralysis, 579.
 DAVIS, JOHN STAIGE: Further note on the Clinical Use of Scarlet Red, 702.
 DEEVER, HARRY: Control of Hemorrhage after Prostatectomy, 441; Treatment in Cases of Fracture of the Patella, 583.
 DEEVER, JOHN B.: The Rational Treatment of Acute Appendicitis, 798; The Technic of Suprapubic Prostatectomy, 438; Treatment of Fractures of the Patella, 581.
 Diverticula of the Lower Bowel, Their Development and Relationship to Carcinoma, 223.
 Diverticulitis, Acute, 682; of the Rectum, 533.
 DOWD, CHARLES M.: Living Typhoid Bacilli in Gall-Bladder Thirty-seven Years after Fever, 870; Plastic Operation for Replacing the Lower Lip, 867; Post-operative Development of Hyperplastic Lymph-nodes, 871; Treatment of Septic Knees, 867.
 DOWNES, WILLIAM A.: Bone Plating for Fracture of Forearm, 571; the Use of the Rectus Muscle in Direct Inguinal Hernia, 568.

E

- EASTMAN, JOSEPH R.: Gastrostomy as a Curative Measure *per se* in Non-Malignant Strictures of the Œsophagus, 318.
- ELIOT, ELLSWORTH, JR.: Decortication of Polycystic Kidney, 131; Intussusception with Special Reference to Adults, 169.
- ELMER, WALTER G.: Sacro-iliac Arthritis Following Typhoid Fever, 731.
- ELLSBERG, CHARLES A.: Anæsthesia by Intratracheal Insufflation of Air and Ether, 161; Aneurism of the Innominate Artery, 545; Exploratory Laminectomy, 543; Further Experiences with Anæsthesia by Intratracheal Insufflation, 749; Osteoplastic Craniectomy, 852; Removal of Tumor of the Spinal Cord by Laminectomy, 848; Spina Bifida Occulta, 543.
- Empyema, De Lorme-Schede Operation for, 845; of Ureter, 378.
- Endo-aneurismorrhaphy for Popliteal Aneurism, 861.
- Epithelioma of Lower Eyelid, 300.
- ERDMANN, JOHN F.: Avulsion of the Tubercle of the Tibia, 431; Bilateral Pneumococcus Mastitis, 726; Calcified Deposit in Mesentery Gland, 853; Carcinoma of the Stomach, 727; Hemorrhagic Pancreatitis, 435; Partial Gastrectomy for Carcinoma of the Pylorus, 728; Pyloric Stenosis from Ulcer, 727; Six Abdominal Sections in One Patient, 728; Stab Wound of the Heart, 727.
- Eserin, Value of, in Paralytic Ileus, 129.
- Exophthalmic Goitre, Partial Thyroidectomy for, 422.
- Exstrophy of the Bladder, 135.
- Eyelid, Epithelioma of the, 300.
- ter Anterior Gastro-enterostomy, 53.
- Fecal Continence, Restoration of, after Iliac Colostomy, 250.
- Femoral Hernia in the Aged, Radical Cure of, 676.
- Femur, Fracture of, Treated by Intramedullary Splint, 541; Treated by Operative Method, 732; Fracture of the Neck of the, Abduction Treatment of, 489; of the Shaft of, 499, 586; Sarcoma of the, 288.
- FOOTE, EDWIN M.: Tumor of the Tongue, 843.
- Forearm Fracture Treated by Bone Plating, 571.
- Fracture of the Femur Treated by Operative Method, 723; of Forearm Treated By Bone Plating, 571; of the Neck of the Femur, the Abduction Treatment of, 489; of the Patella, 508; of the Shaft of the Femur, 499, 586; of the Skull, Compound, Followed by Tetanus, 548; Fractures and Dislocations Treated by the Open Method, 863.

G

- Gall Bladder, 14,000 Calculi Removed from, at One Operation, 590; Importance of Preserving the, in Operations Upon the Gall Passages, 349.
- Gall-stones, Living Typhoid Bacilli Found in, Thirty-seven Years After Fever, 870.
- Gas Cysts of the Intestine, 576.
- Gastrectomy, for Carcinoma—Cases of Partial, 294, 728.
- Gastric Fistula in the Treatment of Perforating Gastric Ulcer, 143; Ulcer, Perforating, 140, 420.
- Gastro-enterostomy, anterior, followed Three Years Later by Posterior, 53; Radiographs for, 863.
- Gastrostomy as a Curative Measure *per se* in Non-Malignant Strictures of the Œsophagus, 318.

F

- FAUNTELROY, M. A.: Posterior Gastro-enterostomy Three Years Af-

- GERSTER, ARPAD G.: Aneurismorrhaphy for Popliteal Aneurism, 538; Gastric Fistula Sequel to Perforating Gastric Ulcer, 143; Iliocecal Resection for Tuberculosis, 539; Resection of Ten Ribs for Tuberculosis of Lung, 539; Treatment of Spreading Peritonitis, 152.
- GIBBON, JOHN H.: Treatment of Acute Appendicitis, 875; Treatment of Fractures of the Patella, 582; Treatment of Ureter in Cases of Tuberculous Kidney, 735; Use of Eserin in Paralytic Ileus, 129; Volkmann's Ischæmic Paralysis, 580.
- GIBSON, CHARLES L.: Avulsion of the Tubercle of the Tibia, 431; Disinfection of the Skin by Tincture of Iodine, 106.
- GIDDINGS, HAROLD G.: Cystadenoma of Supernumerary Kidney, 367.
- GIFFIN, H. Z.: Diverticulitis of the Rectum, 533.
- Glanders Abscess of the Forearm, 573.
- Goitre, Partial Thyroidectomy for Exophthalmic, 422.
- GREEN, NATHAN W.: Epithelioma of the Nose; Operation for, Under Intratracheal Insufflation Anæsthesia, 291; Gastric Fistula in the Treatment of Perforating Gastric Ulcer, 143.
- ## H
- Hands and Feet, Variations of the Bones of the, by Thomas Dwight, Review of, 160; and Fingers, Tumors of the, 290.
- HARTE, RICHARD H.: Fracture of the Shaft of the Femur, 499; Results after Fractures of the Shaft of the Femur, 589.
- HARTWELL, JOHN A.: Carcinoma of the Sigmoid Loop, 298; Treatment of Spreading Peritonitis, 146.
- HARTLEY, FRANK: Ankylosis of the Jaw, 551; Interscapulothoracic Amputation, 556; Nerve Implantation, 555; Removal of Fluids from Peritoneal Cavity by Aspiration, 575.
- HAWKES, FORBES: Acute Ulcer Peritonitis in Typhoid Fever, 651; Tuberculosis of the Spleen, 144.
- HAYNES, IRVING S.: Neurofibroma of the Brachial Plexus, 274; Traumatic Meningocele, 268; Treatment of Spreading Peritonitis, 151.
- Heart, Stab Wound of the, 727; Wounds of the, Operative Treatment of, 324.
- Heels, Bilateral Swelling of Both, 855.
- Hepatitis, Acute, Simulating Stone in the Common Duct and Liver Abscess, 783.
- Hernia, Femoral, Radical Cure of, in the Aged, 676; Inguinal, Associated with Undescended Testis, 301; Strangulated, Coincidence of Volvulus with, 232; Use of the Rectus Muscle in Closing Direct Inguinal, 568.
- HIBBS, RUSSELL A.: An Operation for Stiffening the Knee-joint, 404.
- Hip-joint, Double Non-tuberculous Inflammation of, 426.
- HITZEROTH, JAMES M.: Abscess of the Forearm Due to the Glanders Bacillus, 573; Perforated Ulcer of the Jejunum, 571; Post-typhoid Osteomyelitis of the Radius, 574; Removal of Fluids from Peritoneal Cavity by Aspiration, 75.
- HOTCHKISS, LUCIUS: Acute Pancreatitis, 434.
- Humerus, Osteoma of the Upper End of the, 300, Sarcoma of the, 286; Separation of the Upper Epiphysis of, Treated by Operation, 145.
- ## I
- Ileocecal Resection for Tuberculosis, 539.

Ileus, Paralytic, Value of Eserin in, 129.

Iliac Arteries, Simultaneous Ligation of Both External, 547.

Inguinal Hernia Associated with Undescended Testis, 301; Use of the Rectus Muscle in Closing Direct, 568.

Injury as a Causative Factor in Cancer, 449, 615.

Innominate Artery, Aneurism of the, 543.

Interscapulothoracic Amputation, 556.

Intestinal Adenoma, 416; Stasis, Appendicostomy in Lane's Operation for, 686.

Intestine, Gas Cysts of the, 576; Volvulus of Small, Complicating Appendicitis, 120.

Intramedullary Splint for Fracture of the Femur, 541.

Intratracheal Insufflation, Anæsthesia by, 161, 291, 302, 749.

Intussusception with Special Reference to Adults, 169, 406.

Iodine Catgut, Dry, 110; Tincture, Disinfection of the Skin by, 106.

J

JANEWAY HENRY H.: An Improved Device for Transfusion, 720.

Jaundice, Chronic, Caused by Pressure of Band upon the Duodenum, 565.

Jaw, Ankylosis of the, 551.

Jejunum, Perforated Ulcer of the, 571.

JOHNSON, ALEXANDER B.: Cases of Renal Calculus, 276; Chronic Jaundice Caused by Pressure Upon the Duodenum by a Band, 565; Technic of the Operative Treatment of Appendicitis, 525; Tuberculosis of the Ureter, 563; Tuberculous Bursitis of the Thigh and Groin, 566.

JOPSON, JOHN H.: Case of Subphrenic Abscess Following Appendicitis, 129; Recent Advances

in Pulmonary Surgery, 593; Treatment of Acute Appendicitis, 877; Use of Silver Wire in Treatment of Fracture of the Patella, 583; Volkmann's Ischæmic Paralysis, 578.

K

KAMMERER, FREDERICK: Control of Hemorrhage after Suprapubic Prostatectomy, 429; Disinfection of the Skin by Tincture of Iodine, 437; Treatment of Nerve Injuries, 291.

KELLY, HOWARD A.: Removal of Wedge of Skin and Fat in the Course of Abdominal Operations, 364.

Kidney, Damage done to the, by Operation, 373; Polycystic, Decortication for, 131; Stone, Cases of, 276; Supernumerary Cystadenoma of, 367; Tuberculous, Removal of the Ureter with, 696, 733.

KILIANI, OTTO G. T.: The De Lorme-Schede Operation for Empyema, 846; Tuberculosis of the Skull, 846.

Knee-Joint, an Operation for Stiffening the, 404.

Knees, Septic, Treatment of, 867.

L

LAMBERT A. V. S.: Fractures and Dislocations Treated by the Open Method, 863.

Laminectomy, Exploratory, 543; for Injury and Tumor of Spinal Cord, 754, 848; Unilateral, with Dorsal Root Section for Spastic Conditions, 281.

Lane's Operation for Intestinal Stasis, Appendicostomy in, 686.

Larynx, Cancer of the, Cure Persisting Five and one-half Years after Operation, 546.

LE CONTÉ, ROBERT G.: Use of Eserin in Cases of Paralytic Ileus, 129.

- LILIENTHAL, HOWARD: Fracture of the Femur Treated by Intramedullary Splint, 541; Intratracheal Insufflation Anæsthesia, 302; Late Result of Resection of Colon for Carcinoma, 542; Nephro-ureterectomy, 521; Vesical Calculus and Hypertrophied Prostate, 542.
- LINK, GOETHE: Treatment of Chronic Pancreatitis by Pancreatotomy, 768.
- Lip, Plastic Operation for Cancer of the Lower, 867.
- Liver, Abscess of the, in a Child, 424.
- LONG, JOHN WESLEY: Importance of Preserving the Gall-bladder in Operations upon the Gall Passages, 349.
- Lung Adherent to Subcutaneous Tissue, 847; Injuries, Treatment of, 730; Tuberculosis of, Resection of Ten Ribs in the Treatment of, 539.
- LUSK, WILLIAM C.: Treatment of Innominate Aneurism by Wire Galvanism, 545; Lymph-nodes, Hyperplastic Post-operative Development of, 871.
- M**
- MAKINS, GEORGE HENRY: Retroperitoneal and Mesenteric Cysts of a Simple Nature, 355.
- MARRO, ANDREA: Restoration of Fecal Continence after Iliac Colostomy, 250.
- MARTIN, WALTON: Large Intrathoracic Cysts of the Thyroid Gland Causing Dyspnea, 737; Partial Thyroidectomy for Exophthalmic Goitre, 422; Perforated Gastric Ulcer; Pneumococcus Subphrenic Abscess, 420; Nephrotomy for Suppurative Nephritis following Lumbar Ureterostomy, 423.
- MARTIN, EDWARD: The Technic of Prostatectomy, 440; Treatment of Acute Appendicitis, 877.
- Mastitis, Bilateral Pneumococcus, 726.
- Matas's Aneurismorrhaphy for Popliteal Aneurism, 538.
- MATAS, RUDOLPH: Testing the Efficiency of the Collateral Circulation, Preliminary to Occlusion of the Great Surgical Arteries, 1.
- MATTHEWS, FRANK S.: Brain Injury by Contrecoup, 428; Double Acute Non-tuberculous Coxitis, 426; Liver Abscess in a Child, 424; Myeloma of the Tendon Sheath, 847.
- MCWILLIAMS, CLARENCE A.: Perforating Gastric Ulcer, 140.
- Median Nerve, Injury of, Through Pistol Shot Wound, 292.
- MELTZER, S. J.: Thoracotomy under Differential Pressure, 304.
- Meningocele, Traumatic, 268.
- Mesenteric Cysts of a Simple Nature, 355; Gland, Calcified Deposit in, 853.
- Mesentery, Chylous Cysts of the, 692; and Omentum, Sarcoma of the, 139.
- MEYER, WILLY: Thoracotomy and Oesophageal Plication for Cardiospasm, 293; Treatment of Spreading Peritonitis, 153.
- MILLER, MORRIS BOOTH: Use of Eserin in Cases of Paralytic Ileus, 129.
- MILLER, ROBERT T., JR.: Coincidence of Volvulus and Real or Simulated Strangulated Hernia, 232.
- MOORE, JAMES E.: Damage Done to the Kidney by Operation, 373.
- Moorhof Bone Plug, Results of the Use of, at the University of Minnesota, 699; Bone Wax, Treatment of Bone Abscess by, 67.
- MORRIS, ROBERT T.: Dislocation of the Carpal Semilunar Bone, 847; Lung Adherent to Subcutaneous Tissue, 847; Treatment of Spreading Peritonitis, 151.
- MOSCHCOWITZ, ALEXIS V.: Bacteria Present in Peritonitis, 154; Cellu-

- litis of the Space of Retzius, 436;
Cure of Carcinoma of the Larynx Persisting Five and One-half Years, 546; Dry Iodine Catgut, 110; Operative Treatment of Acute Pancreatitis, 436; Phlegmon of the Space of Retzius, 291; Simultaneous Ligation of Both External Iliac Arteries, 547; Suppurative Portal Pylephlebitis, 549; Tetanus Following a Compound Fracture of the Skull, 548.
- MULLER, GEORGE P.: Cases of Recurrent Bilateral Fractures of the Patella, 584; Laminectomy for Injury and Tumor of the Spinal Cord, 754; Treatment of Acute Appendicitis, 879; Use of Eserin in Cases of Paralytic Ileus, 129.
- MURRAY, FRANCIS W.: Aspiration of the Peritoneal Fluids, 575; Cyst of the Pancreas, 558.
- Myeloma of Tendon Sheath, 847.

N

- Nasal Fossa Sarcoma, 856.
- NEILSON, THOMAS R.: Selection of Cases for Prostatectomy, 441.
- Nephrotomy following Lumbar Ureterostomy, 423.
- Nephro-ureterectomy, 521.
- Nerve Anastomosis, Use of Vein Cuff to Protect, 580; Implantation, 555; Injuries, Treatment of, 292; Suture for Rupture of the Brachial Flexus, 858.
- NEW YORK SURGICAL SOCIETY, Transactions of the, 131, 268, 291, 420, 538, 551, 722, 843, 854.
- Nose, Epithelioma of the, Removed under Intratracheal Insufflation Anæsthesia, 291.

O

- Oesophageal Plication for Cardiospasm, 293.
- Oesophagus, Non-malignant Strictures of, Gastrostomy as a Curative Measure *per se*, 318.
- Omentum, Sarcoma of the, 139.
- Organoscopy, 764.
- Orthopædic Surgery, Treatise on, by Royal Whitman, Review of, 444.
- Osteoma of Humerus, 300.
- Osteomyelitis of the Sacro-iliac Bone, 115.
- Ovary, Cystadenoma of the, 136.

P

- Palate, Soft, Endothelioma of the, 283.
- Pancreas, Cysts of the, 558.
- Pancreatitis, Acute Hemorrhagic, 432; Hemorrhagic, Recurrent, 566; Treatment of Chronic, 768.
- Pancreatostomy in the Treatment of Chronic Pancreatitis, 768.
- Paralysis, Volkmann's Ischæmic, 578.
- Parathyreopriva Tetania, Parathyroid Implantation in the Treatment of, 305.
- Parathyroid Implantation in the Treatment of Tetania Parathyreopriva, 305.
- Patella, Fracture of the, 508, 581.
- PECK, CHARLES H.: Acute Hemorrhagic Pancreatitis, 433; Brachial Plexus, Neurorrhaphy, for Rupture of the, 858; Carcinoma of the Cæcum, 298; Colectomy, Partial, for Carcinoma of the Splenic Flexure, 297; Endo-aneurismorrhaphy for Popliteal Aneurism, 861; Gastro-enterostomy, Radiographs for, 863; Laryngotomy for Syphilitis Perichondritis, 859; Partial Gastrectomy for Carcinoma, 294; Neurorrhaphy for Rupture of the Brachial Plexus, 859; Sarcoma of the Nasal Fossa, 856; Treatment of Spreading Peritonitis, 153.
- Pediatric Practice, Use of X-ray in, by Dr. Thos. M. Rotch, Review of, 159.
- Perineal Prostatectomy, Technic of Median, 390.

Peritonitis, Spreading, Treatment of, 146; in Typhoid Fever, 651.
 PFAHLER, GEORGE E.: Union of Greatly Overlapped Fragments in Fractures of the Femur, 588.
 Pituitary Gland, Anatomical and Surgical Desiderata in the Removal of the, 44.
 PHILADELPHIA ACADEMY OF SURGERY, Transactions of the, 115, 437, 578, 730, 873.
 PILCHER, PAUL M.: Radical Cure of Femoral Hernia in the Aged, 676.
 Pneumococcus Mastitis, Bilateral, 726; Subphrenic Abscess, 420.
 POOL, EUGENE H.: Hemorrhagic Pancreatitis, Recurrent, 567.
 Portal Pylephlebitis, Suppurative, 549.
 Post-typhoid Abscess of the Radius, 574.
 Prostatectomy, Median Perineal, The Technic of, 390; Suprapubic, Control of Hemorrhage after, 429; Suprapubic, Technic of, 438.
 Psoas Abscess, Early Operation for Tubercular, 115.
 Pulmonary Surgery, Recent Advances in, 593, 730.
 Pylephlebitis, Portal, Suppurative, 549.
 Pyloric Stenosis from Gastric Ulcer, 727.
 Pylorus, Partial Gastrectomy for Carcinoma of the, 728.

R

Rectum, Diverticula of the, 223; Diverticulitis of the, 553.
 Renal Calculus, Cases of, 276.
 Retention, Urinary, of the Senile Bladder, Non-prostatic, 57.
 Retroperitoneal and Mesenteric Cysts of a Simple Nature, 355.
 Retzius, Cellulitis of the Space of, 291, 436.
 ROBERTS, JOHN B.: Fractures of the Shaft of the Femur, 587.
 ROBINSON, SAMUEL: Operative Treatment of Wounds of the Heart, 324.
 ROCKEY, A. E.: Appendicostomy in Lane's Operation for Intestinal Stasis, 686.
 ROGERS, JOHN: Intrathoracic Cysts of the Thyroid, 854.
 Rontgen Ray in Pediatric Practice, by Thomas M. Rotch, Review of, 159.
 ROSS, GEORGE G.: Fatal Result of Operation for Fracture of the Patella, 583; Treatment of Ureter in Cases of Tubercular Kidney, 734; Treatment of Acute Appendicitis, 878.
 RUSSELL, JAMES I.: Bilateral Swelling of Both Heels, 855; Operation for Double Undescended Testis, 845; Sarcoma of Tendon Sheath, 285.

S

Sacral laminectomy for Tubercular Monoplegia, 116.
 Sacro-iliac Arthritis following Typhoid Fever, 730; Bone, Osteomyelitis of the, 115.
 Sarcoma of the Humerus, 286; Intra-abdominal, Cure of by Mixed Toxins, 299; of the Nasal Fossa, 856; of the Scapula, 844; of Tendon Sheath, 285.
 Scapula, Sarcoma of the, Cured by Mixed Toxins, 844.
 Scarlet Red, Further Note on the Clinical Use of, 702.
 SCHACHNER, AUGUST: 14,000 Calculi Removed from the Gall-bladder at One Operation, 590.
 SCHMITT, A. EMIL: Anatomical and Surgical Desiderata in the Exposure and Removal of the Pituitary Gland, 44.
 Semilunar Bone of Carpus, Dislocation of the, 847.
 SHOBER, JOHN B.: Treatment of Ureter in Cases of Tuberculous Kidney, 733.

- SHOEMAKER, GEORGE E.: Removal of the Ureter with a Tuberculous Kidney, 696, 733.
- Shoulder-joint, Laceration of the Capsule of, in the Etiology of Traumatic Combined Paralysis of the Upper Extremity, 77, 116.
- Sigmoid Loop, Carcinoma of the, 298.
- SIMMONS, CHANNING C.; Bone Abscess Treated with Moorhof's Bone Wax, 67.
- SINCLAIR, H. H.: The Control of Urinary Drainage after Cystotomy, 387.
- SKILLERN, M. G.: Disjunction of Upper Epiphysis of Ulna, 873.
- Skin, Disinfection of, by Tincture of Iodine, 106.
- Skull, Compound Fracture of, Followed by Tetanus, 548; Tuberculosis of the, 846.
- Spastic Diplegia and Hemiplegia, Unilateral Laminectomy with Dorsal Root Section for, 281.
- Spina Bifida Occulta, 543.
- Spinal Cord, Laminectomy for Injury and Tumor of the, 754; Surgical Operation for Removal of Tumor of the, 848.
- Spleen, Tuberculosis of the, 144.
- Splenic Flexure, Partial Colectomy for Carcinoma of the, 297.
- STEINBACH, LEWIS W.: Case of Fracture of Patella Treated by Operation, 585.
- STEWART, GEORGE B.: Treatment of Spreading Peritonitis, 150.
- STEWART, J. CLARK: Results of the Use of the Moorhof Bone Plug in the Surgical Clinic of the University of Minnesota, 699.
- Stomach, Cancer of the, 727; Cases of Partial Gastrectomy for Cancer of the, 294; Perforating Ulcer of the, 140; Ulcer of, with Pyloric Stenosis, 727.
- Stone in the Bladder, 542.
- Subphrenic Abscess, Pneumococcus, 420; Sequel to Appendicitis, 118.
- Surgical After-treatment, by L. R. G. Crandon, Review of, 155.
- Surgical Anatomy, by Jno. A. C. Macewen, Review of, 157.
- SWEET, J. EDWIN: Use of Vein Cuff to Protect Nerve Anastomosis, 581.
- SYMS, PARKER: Treatment of Spreading Peritonitis, 152.
- Syphilitic Perichondritis, Laryngotomy for, 859.

T

- TAYLOR, ALFRED S.: Cases of Unilateral Laminectomy with Dorsal Root Section for Relief of Spastic Conditions, 281; Endothelioma of the Soft Palate, 283; Fracture of the Transverse Process of the Cervical Vertebrae, 284.
- Temporomaxillary Articulation, Ankylosis of the, 551.
- Tendon Sheath, Myeloma of the, 847; Sarcoma of, 285.
- Testis, Perineal, Transplanted into Scrotum, 844; Undescended, Associated with Inguinal Hernia, 301; Operation for, 854.
- Tetania Parathyreopriva, Parathyroid Implantation in the Treatment of, 305.
- THOMAS T. TURNER: Laceration of the Axillary Portion of the Capsule of the Shoulder-joint in Etiology of Traumatic Combined Paralysis of the Upper Extremity, 77, 116.
- Thoracotomy under Differential Pressure for Sarcoma of the Chest Wall, 304; and Oesophageal Plication for Cardiospasm, 293.
- Thyroid Gland, Large Intrathoracic Cysts of the, 737, 853.
- Thyroidectomy, Partial, for Exophthalmic Goitre, 422.
- Tibia, Avulsion of the Tubercle of the, 431.
- TILTON, BENJAMIN T.: Acute Hemorrhagic Pancreatitis, 432.
- Tongue, Tumor of, 843.

Transfusion of Blood in an Adult, 131, 132; an Improved Device for, 720.

Tuberculosis, Ilio-cecal Resection for, 539; of the Kidney, Removal of the Ureter with, 696, 733; of Lung, Resection of Ten Ribs for the Cure of, 539; of the Skull, 846; of the Spleen, 144; of the Ureter, 563.

Tuberculous Bursitis of the Thigh and Groin, 566.

TURCK, RAYMOND C.: The Treatment of X-ray Ulcer, 47.

TURNURE, P. R.: Gas Cysts of the Intestine, 576.

Typhoid Bacilli Persisting in Gall-bladder for Thirty-seven Years, 870; Fever, Acute Ulcer Peritonitis in, 651; followed by Sacro-iliac Arthritis, 730.

U

Ulcerations, Treatment of, by Scarlet Red, 702.

Ulna, Disjunction of Upper Epiphysis of, 873.

Ureter, Calculus Impacted in, 137; Empyema of the, 378; Observations upon the Surgery of the, 827; Removal of the, after Nephrectomy, 521; Removal of the, with a Tuberculous Kidney, 696, 733; Tuberculosis of the, 563.

Ureterostomy, Lumbar, followed by Suppurative Nephritis, 423.

Urinary Drainage, Control of, after Cystotomy, 387; Retention of the Senile Bladder, Non-prostatic, 57.

V

Variations of the Bones of the Hands and Feet, by Thomas Dwight, Review of, 160.

Vesical Calculus and Hypertrophied Prostate, 542.

Volkman's Ischæmic Paralysis, 578.

Volvulus, Coincidence of, with Strangulated Hernia, 232; of Small Intestine Complicating Appendicitis, 120.

VOSBURGH, ARTHUR S.: Pistol Shot Wound of the Arm, 292.

W

WALKER, JOHN B.: Five Cases of Fracture of the Femur Treated by the Operative Method, 722.

WARE, MARTIN W.: Non-prostatic Urinary Retention of the Senile Bladder, 57.

WATTS, STEPHEN H.: Intussusception in the Adult, 408.

Wax, Moorhof's, for the Treatment of Bone Abscess, 67.

WHARTON, HENRY R.: Treatment of Lung Injury, 730.

WHITMAN, ROYAL: The Abduction Treatment of Fracture of the Neck of the Femur, 489.

WILSON, LOUIS B.: Diverticula of the Lower Bowel; Their Development and Relationship to Carcinoma, 223.

WOOLSEY, GEORGE: Cystadenoma of the Ovary, 136; Exstrophy of the Bladder, 135; Sarcoma of the Omentum and Mesentery, 139; Transfusion of Blood in Pernicious Anæmia, 131; Treatment of Acute Pancreatitis, 436; Ureteral Calculus, 137.

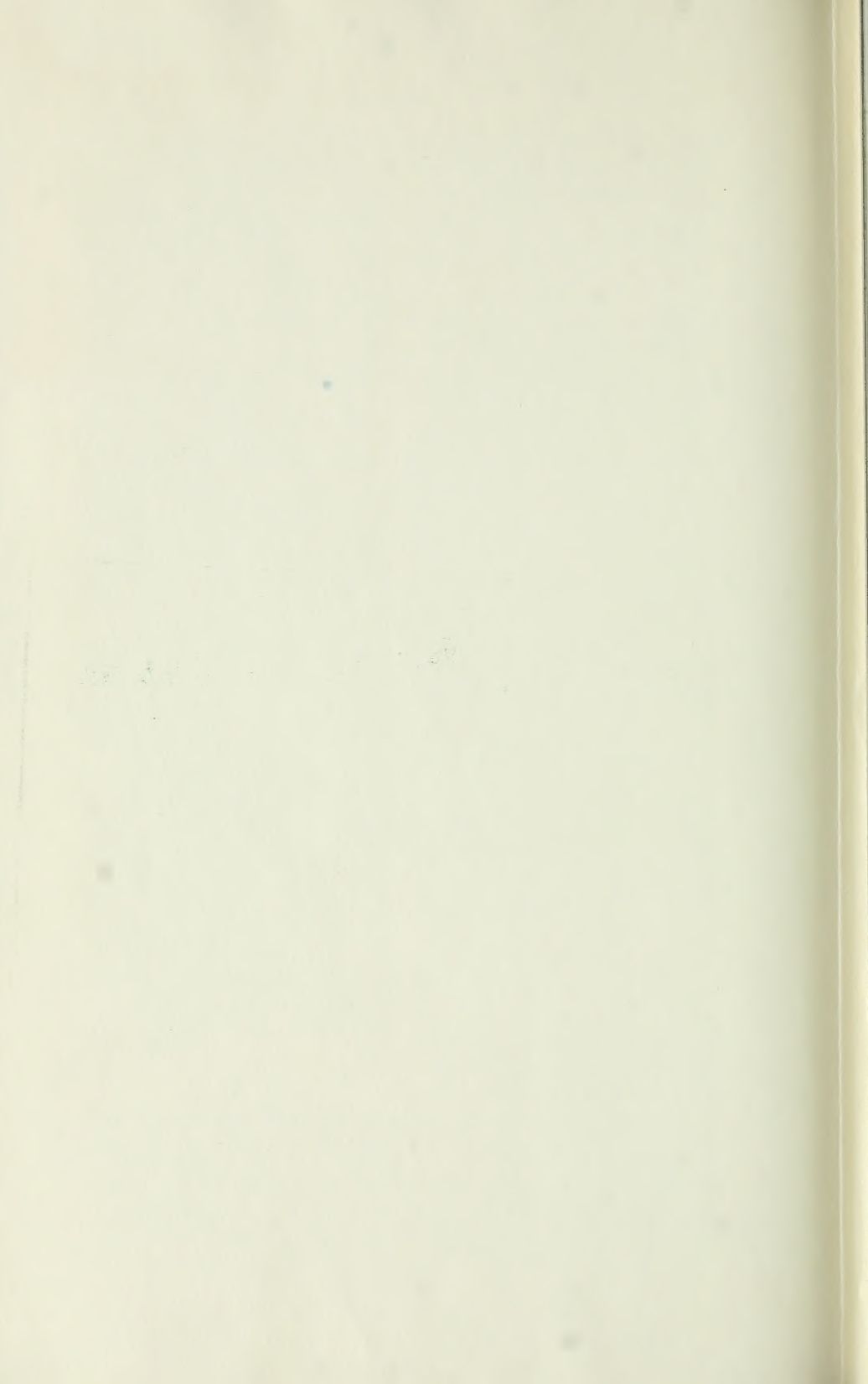
X

X-ray Ulcer, the Treatment of, 47.

Y

YOUNG, JAMES K.: Early Operation for Psoas Abscess, 115; Etiology of Traumatic Paralysis of the Upper Extremity in Children, 116; Lambotte Method for Treating Fractures of the Shaft of the Femur, 196; Osteomyelitis of the Sacro-iliac Articulation, 115; Sacral Laminectomy for Tubercular Monoplegia, 116.





RD

Annals of surgery

1

A5

v.53

1911
Biological

& Medical

Serials

PLEASE DO NOT REMOVE
CARDS OR SLIPS FROM THIS POCKET

UNIVERSITY OF TORONTO LIBRARY

STORAGE

